HANSON ENGINEERING P.C.
Soils, Foundations & Underground Specialists

Report On

Final Slurry Wall Design
Separation Barrier Wall Installation
ASC RD/RA Group
Barrier Wall Extraction System Upgrades
Off Site Area

AMERICAN CHEMICAL SERVICE SUPERFUND SITE

Griffith, Indiana

Prepared for:

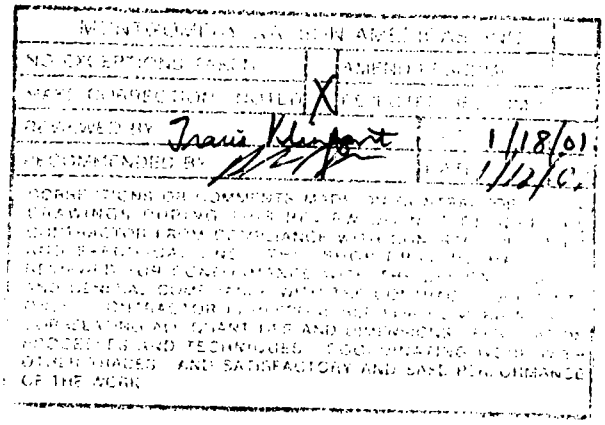
CONTRACT DEWATERING, INC.

Prepared By:

HANSON ENGINEERING, P.C.

Project No. 00192-011

January 6, 2001



APPROVAL IS CONTINGENT UPON COMPLETING CONDITIONS ADDRESSED IN ATTACHED LETTER (DATED JAN. 17, 2001), WHICH IS INCORPORATED INTO THIS DOCUMENT

MONTGOMERY WATSON

January 18, 2001

Mr. Kevin Adler
Remedial Project Manager
U.S. Environmental Protection Agency
Region V, SR-6J
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Separation Barrier Wall
Submittal Review of the Final Slurry Wall Design Dated January 6, 2001
ACS NPL Site

Dear Mr. Adler:

Please find enclosed a copy of the Final Slurry Wall Design for the American Chemical Service NPL Site in Griffith, Indiana. This design report has been submitted by Hanson Engineering on behalf of Contract Dewatering Services (CDS), who is under contract with Montgomery Watson for the installation of the Separation Barrier Wall. Montgomery Watson has reviewed the design report and has marked up in red ink corrections which CDS and Hanson agreed to during a meeting held January 16, 2001. We have also attached a copy of our letter to CDS dated January 17, 2001 which summarizes the corrections agreed upon.

We are also sending a copy of this report to IDEM and Black & Veatch. If you need additional copies of this report please let me know and we can forward them to you, or whomever you specify.

Sincerely,

MONTGOMERY WATSON

Peter J. Vagt, Ph.D., CPG
Project Manager

cc: Sean Grady, IDEM (1 copy)
Larry Campbell, B&V (1 copy)

TMK/PJV
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27755 Diehl Road
Suite 300
Warrenville, Illinois
60555

Tel: 630 836 8900
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Serving the World's Environmental Needs

MONTGOMERY WATSON CONSTRUCTORS, INC.

January 17, 2001

Contract Dewatering Services, Inc
5820 W. Riverside Drive, Box 1
Saranac, MI 48881

Re: Submittal Review of the Final Slurry Wall Design Dated January 6, 2001

Dear Mr. Richard Newmann

Attached is the Hanson Engineering Slurry Wall design for the ACS separation barrier wall. The Final Slurry Wall Design dated January 6, 2001, the Work Plan for the Construction of the Separation Barrier Wall, and The CQC Plan are addressed in this letter. The Health and Safety Plan provided in the design document is not addressed in this letter and it should be noted that only the most recent Health and Safety plan available should be used. The Final Slurry Wall Design Separation Barrier Wall Installation dated January 6, 2001 is approved pending the following conditions and amendments:

- The changes noted in the Final Slurry Wall Desing outlined in red ink are implemented.

- Approval of this design document is dependant upon the testing data from NTH using ISPA method 9100 showing the design will meet Montgomery Watson's objectives. Documentation of the all tests and results should be submitted upon completion. A summary of the results should be included with the tests and results and should address how its relavence to the design and should include a statement that the tests provide adequate proof that the wall will meet the desin objectives.

- The preliminary data from the groundwater analysis by Semilabs will not substantially change. Only The final results should be used for the design of the slurry wall and a copy of the final analytical results should be submitted upon completion.

- CDS will not connect the separation slurry wall to the existing perimeter slurry wall. The slurry wall should stop three feet from the existing perimeter slurry wall on the east and west endpoint. CDS will then turn the trencher parallel with existing slurry wall and make a ten feet long trench on the east and west endpoints of the separation wall. The ten foot long slurry trench should extend equally on either side of the separation wall and should be twenty four inches wide and should key no more than two (2) feet into the clay layer.

- Hydrogell 90 has been submitted in the design as the material of use, therefore, CDS should provide documentation that the material onsite is in fact Hydrogell 90.

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- The unit weight of sand does not specifically describe the native soil at ACS. CDS should measure the unit weight of the sand and use the parameters necessary to obtain an accurate design mix for actual site conditions.

- Prior to wall installation CDS should provide a sampling schedule to include the amount of samples to be collected, frequency , location, and analysis. The sampling schedule to outline whether the sampling will be tested in the field or the lab.

- A slump test should be performed within the first 15 feet of wall installation.

- A design slump should be established based on the lab tested slurry/soil mix. The design slump should be provided to Montgomery Watson before installation begins.

- The SBW shall key into the clay two (2) feet. The clay elevation will be established and documented before beginning work.

If you should have any question please call me at 630-836-8924.

Sincerely

Todd Lewis

Cc: Robert Adams
File

J:\209\0601 ACS\0105 Barrier Wall\CDS Submittal Approval Letter.doc

MONTGOMERY WATSON AMERICAS INC

NO EXCEPTIONS TAKEN | AMEND/RESUBMIT

MAKE CORRECTIONS NOTED X | REJECTED

REVIEWED BY | DATE

RECOMMENDED BY | DATE 1/23/01

CORRECTIONS OR COMMENTS MADE ON CONTRACT DRAWINGS DURING THIS REVIEW DO NOT RELIEVE CONTRACTOR FROM COMPLIANCE WITH CONTRACT DRAWINGS AND SPECIFICATIONS. THIS SHOP DRAWING HAS BEEN REVIEWED FOR CONFORMANCE WITH THE CONTRACT DOCUMENTS AND GENERAL COMPLIANCE WITH THE CONTRACT DOCUMENTS. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRELATING ALL QUANTITIES AND DIMENSIONS, FABRICATION PROCESSES AND TECHNIQUES, COORDINATING WORK WITH OTHER TRADES AND SATISFACTORY AND SAFE PERFORMANCE OF THE WORK

HANSON
ENGINEERING P.C.
Soils, Foundation & Underground Specialists

January 6, 2001
Project No. 00192-011

Mr. John Flak
Contract Dewatering, Inc.
5820 West Riverside Drive
P.O. Box 1
Saranac, Michigan 48881

Re: Report on Final Slurry Wall Design
Separation Barrier Wall Installation
ACS RD/RA Group
Barrier Wall Extraction System Upgrades
Off Site Area
American Chemical Service Superfund Site
Griffith, Indiana

Dear Mr. Flak:

In accordance with your request, we have reviewed the project plans and specifications prepared by Montgomery Watson for the above referenced project. The Separation Wall Installation Portion of the project is located within the "Off Site" segment of the ACS Superfund Site in Griffith, Indiana. The ACS Superfund Site is bisected in an east to west direction by a series of railroad tracks. The "Off Site" area is located south of the railroad tracks. As part of the site remediation program, a composite barrier wall has already been constructed by Horizontal Technologies, Inc., around the entire perimeter of the Superfund Site, both north and south of the railroad alignment. In addition to the perimeter barrier wall system, eight 100 foot long ground water extraction trenches were installed to maintain a hydraulic capture zone within the barrier wall.

The Barrier Wall Extraction System Upgrades Project involves the installation of a Separation Barrier Wall to be located approximately 25 feet south of the southernmost rail of the railroad tracks. The objective of the separation barrier wall is to provide a continuous, vertical hydraulic cutoff wall to isolate subsurface contamination on the southern portion of the site (Off Site Area) and prevent migration of contaminants to the northern side of the site (On Site Area). The separation barrier wall must tie into the perimeter barrier wall system to effectively prevent migration of ground water and contaminants at the joints. In addition, the separation barrier wall must maintain a hydraulic conductivity of less than 1×10^{-7} cm/sec, which is similar to the perimeter wall system. The design of the interior wall needs to account for the fact that the wall will be exposed to known contaminants for an extended period of time. Pump and treat operations of the contaminated ground water inside either the "Off Site" or "On Site" areas may occur resulting in a

- This design submittal was prepared on behalf of Contract Dewatering Services, who is under contract with MWCI for the subject project.

9366 Lilley Road ○ Plymouth, MI 48170 ○ *Phone:* (734) 454-6560 ○ *Fax:* (734) 454-7423

gradient across the barrier wall of as much as 30 feet. The life of the Separation Barrier Wall is 10 years.

Site Geologic Conditions

Based on the data presented in the bidding documents and in the "Technical Memorandum – Dewatering/Barrier Wall Alignment Investigation Report; American Chemical Services, Inc.; NPL Site; Griffith, Indiana" prepared by Montgomery Watson and dated August, 1996, the site geology is relatively uniform. Additional subsurface information is presented on Drawing C-15 for the Barrier Wall Extraction System Upgrades, dated September 2000. These data indicate that along the proposed Separation Barrier Wall alignment, a total of five soil borings have been performed (Boring Nos. SB-216, SB-217, SB-218, SB-219 and SB-223). The soil profile presented in the September 2000 plans indicates that the site is underlain by a layer of gray silty clay which is encountered at elevations ranging from Elevation 618 to Elevation 619. Hydraulic conductivity tests were performed on samples of the clay layer with the results indicating that the silty clay deposit exhibited a permeability ranging from 1.7×10^{-8} to 2.4×10^{-8} cm/sec. These test results were based on falling head tests using a fixed wall permeameter. The soils above the clay deposit generally consist of medium silty sands. The ground surface elevation along the Separation Barrier Wall alignment ranges from approximately Elevation 638.5 at the intersection with the perimeter barrier wall on the west to approximately Elevation 645 at the intersection point with the perimeter barrier wall on the east. The alignment of the barrier wall is shown on Drawing C-2 – Barrier Wall and Barrier Wall Extraction System Piping Layout of the September 2000 package. Elevations are NGVD Datum. It is our understanding that the Separation Barrier Wall is to ~~penetrate~~ into the clay layer below approximately Elevation 618 to achieve the vertical cut-off.

Existing Perimeter Barrier Wall System

It is our understanding that the existing perimeter barrier wall system was constructed using a one- pass trencher system to excavate, mix and place the soil - bentonite cutoff wall. A geomembrane panel system was then installed within the soil-bentonite slurry. The perimeter barrier wall system was constructed by Horizontal Technologies, Inc. (HCI). Review of Drawing HT-GR-02 included in the present bid package for reference indicates that the existing perimeter barrier wall system consists of an 18 inch wide trench with a 60 mil HDPE liner placed vertically within the trench. The drawing also indicates that the soil-bentonite slurry portion of the barrier wall to have a permeability (hydraulic conductivity) less than 1×10^{-7} cm/sec. The perimeter barrier wall system is shown to extend approximately 3 feet into the underlying clay layer. It is also understood that the design life of the existing perimeter barrier wall is 30 years and that the geomembrane panels were installed within the soil-bentonite slurry to provide the required lifetime of the wall.

As part of the HTI barrier wall design, a soil-bentonite mix design was performed by J&L Testing Company, Inc. The mix design is presented in a letter report to Mr. Greg Rawl of HTI dated

January 31, 1997. The report is entitled "Final Report – Backfill Mix Design and Compatibility and Geomembrane Seam Evaluation; American Chemical Service, Inc. NPL Site; Griffith, Indiana". For completeness, a copy of the J&L Testing Report has been included herewith as Appendix A.

Review of the J&L Mix Design Report indicates that a series of soil-bentonite mixtures were prepared and hydraulic conductivity test performed on each of the mixes. The bentonite utilized in the test program was a Hydrogel 90 manufactured by Wyo-Ben, Inc. A series of soil borings were taken along the barrier wall alignment and a composite sample of the sand materials prepared. The soil-bentonite mixtures were prepared with percentages of bentonite of 2%, 3% and 4% based on a dry weight of soil basis. Water was added to the soil-bentonite mixture until a slump of approximately 8 inches was achieved. Hydraulic conductivity tests were performed on the mixes using a flexible wall permeameter. The mix was pre-consolidated in a rigid wall slurry forming device under an effective pressure of 6 psi. The sample was then placed in a flexible wall permeameter and allowed to consolidate an additional amount under a the following conditions:

- Cell Pressure 50 psi
- Headwater Pressure 42 psi
- Tail water Pressure 38 psi

Two series of permeability tests were performed. The first phase of the testing used tap water as the permeant . The second phase was an EPA 9100 Compatibility Test program using contaminated ground water from the site and a 4% soil-bentonite mixture. Based on the J&L Testing program, the following permeability values were obtained using tap water as the permeant:

Percentage Bentonite	Permeability (cm/sec)
• 2%	1.38×10^{-7} Table
• 3%	9.22×10^{-8}
• 4 %	1.53×10^{-8}

The test results for the EPA 9100 Compatibility Test resulted in a permeability of 2.45×10^{-8} cm/sec. The EPA Compatibility Test took approximately 98 day to complete.

Based on the results of the J&L Testing program, a soil-bentonite mix design consisting of 4% bentonite by dry weight of soil was selected for the perimeter wall barrier system. It is our understanding that the wall was installed by placing a pre-measured quantity of dry bentonite into a shallow pre-trench and then mixing the bentonite with the soil in place using a one pass trencher. Additional liquid bentonite slurry was injected into the trencher to provide the required consistency, which resulted a slump of approximately 8 inches.

Contaminant Concentrations in Ground Water

Included in the project documents prepared by Montgomery Watson (MoW) was a summary of the contaminant concentrations previously measured in the ground water at the project site. This summary was identified as "Contaminant Concentrations in Groundwater – Table 1. The table indicated the contaminant range detected and the expected concentrations. For completeness, we have included a copy of this table in Appendix B.

A Sample of the ground water at the site was obtained by Contract Dewatering on Nov. 21, 2000 and submitted for quality analysis to SIMALABS International. The sample was tested for Semi-volatile Organics, Total Metals, and Volatile Organics. The results of the SIMALABS analytical testing program are included in Appendix C. We have also prepared a comparison table of the results of the SIMALABS analytical results with those presented in the contract proposal. This comparison table is presented as a Comparison Summary of Contaminant Concentrations in Ground Water, Table 1 in Appendix C.

Review of the results presented on the comparison summary indicates that the heavy metal concentrations are generally in the range of the expected concentrations. However, the concentrations levels of many of the organic materials, while still within the concentrations ranges detected on the site, are well above the expected ranges listed in the contract proposal.

Separation Barrier Wall Design

The objected of the Separation Barrier Wall (SBW) is to provide a hydraulic separation between the "On Site" and "Off Site" portions of the ACS site. The separation must extend from the ground surface into the underlying silty clay stratum encountered below approximately Elevation 618.5. The cut-off wall must have a hydraulic conductivity of less than 1×10^{-7} cm/sec and a design life of 10 years. The maximum potential hydraulic gradient of 30 feet may exist across the wall.

a minimum

The project specifications allow the use of a soil – bentonite systems for the Separation Barrier Wall (SBW). Contract Dewatering Services, Inc. has proposed to construct a mixed in place soil-bentonite wall constructed using a one pass trencher. The proposal is to place dry bentonite into a shallow pre-trench and then mix with the existing soils utilizing a 24 inch diameter wide trencher. Liquid bentonite slurry will be injected into the trencher and mixed with the soil and dry bentonite to achieve a uniform mix with a slump in the range of 4 to 8 inches. This is essentially the same system used to construct the perimeter barrier wall system without the HDPE liner. The purpose of this design effort is to verify the mix design developed by J&L Testing and utilized by HTI in the construction of the perimeter wall system and to use this same mix for the SBW.

if it meets the current specifications for the SBW

Sample Collection and Testing Program for SBW

During the week of November 23, 2000, a series of test borings were made by Contract Dewatering Services, Inc. (CDW) along the proposed SBW alignment. The alignment was located approximately 25 feet south of the southernmost track of the existing railroad track which bi-sects the ACS site. The borings were taken to verify the depth to the surface of the underlying silty clay stratum and to obtain a composite sample of the sand overlying the clay for testing purposes. A sample of the ground water was also obtained during this exploration activity. The samples were transported to the offices of Hanson Engineering, P.C. (HE) and were then relayed to NTH Consultants, LTD. (NTH) for testing and analysis.

Since the purpose of the design is to essentially verify the design previously utilized for the ACS perimeter barrier wall, two soil-bentonite mixes were made using 4% bentonite by weight of soil. The dry unit weight of the on site sand has been assumed to be 100 pound per cubic foot (pcf), as was assumed in the J&L Testing program. The present testing program began the week of November 27, 2000 and has been continuously ongoing since. The purpose of the testing program is to determine the hydraulic conductivity of the 4% soil-bentonite mix using both de-aired tap water and the ground water sample obtained from the site. At the writing of this report, the testing of the samples with de-aired tap water is complete and the testing with ground water from the site is on-going. We have received a summary letter from NTH indicating that the tests are being performed in accordance with a fixed all permeameter in accordance with EPA Method 9100, section 2.6. The letter regarding the status of the testing and test results to date are included herewith as Appendix D. The test results using tap water indicate that the mix exhibits a hydraulic conductivity in the range of 6×10^{-8} cm/sec to 7×10^{-8} cm/sec. Preliminary results using the site ground water indicate no significant change in the hydraulic conductivity. The final results of the testing program will be presented in a supplemental letter as soon as they become available. It is important to note that the long term compatibility testing by J&L Testing indicated that the hydraulic conductivity of the soil-bentonite mix did not degrade when the site water was used as the permeant.

Based on the data developed to date, the amount of dry bentonite to be placed into the two foot wide trench should be equal to 8 pounds per foot of trench depth. The bentonite may be a combination of measured weight of dry material placed into a pre-trench plus the bentonite concentration of any water-bentonite slurry injected along the trencher chain. The soil-bentonite should be mixed with the trencher to achieve a uniform mixture with a slump in the range of 6 to 8 inches.

SBW Location

The project plans require that the SBW be located approximately A MINIMUM OF 25 feet south of the southernmost rail of the railroad lines which bi-sect the site. The SBW is to extend from the perimeter barrier wall on the west to the perimeter barrier wall on the east along this alignment. The

plans provided with the bidding documents clearly show the rails and the termination points at the perimeter barrier wall are being provided in the field by Montgomery Watson. Based on superimposing this potential alignment on the plans previously prepared by HTI, end points for the SBW are projected to be N6704, E5060 at the west end and N6380, E5715 at the intersection point with the east perimeter wall. The wall alignment is shown on Drawing C-2 of the September 2000 project plans prepared by Montgomery Watson. A copy of this plan has been reproduced and is included herewith as Appendix E. The end coordinates for the SBW have been superimposed on this drawing. A detailed site plan with actual location of the SBW will be submitted with the "As Built" information at the completion of the project.

SBW Hydraulic Considerations

The SBW will be extended 2 feet into the silty clay stratum, which underlies the site at approximately elevation 618.5. The SBW will be 24 inches in width, which is the minimum width clay layer. The depth to the bottom of the trench will be checked once the trencher has passed. The wall will consist of a soil-bentonite mix with a demonstrated hydraulic conductivity of less than 1 x 10^{-7} cm/sec. The hydraulic conductivity of the native medium sands is estimated to be in the range of 1 x 10^{-2} cm/sec to 1 x 10^{-4} cm/sec. Thus, the soil - bentonite wall will be at least 1000 time less permeable than the native soils. Thus, the 2 foot wide barrier wall extending 2 feet into the underlying clay material has an equivalent thickness of at least 2000 feet of native sands, based on the ratio of the hydraulic conductivity values alone. As long as the soil-bentonite wall is continuously supported by soil on both sides, lowering the water level 30 feet across the wall will have no significant effect on the barrier wall.

SBW Construction Considerations

As previously stated the construction of the SBW will be by the one pass trencher method. The method of construction is discussed in CDI's Work Plan, which has been submitted previously under separate cover. For completeness, a copy of the CDI work plan has been included herewith as Appendix F. A copy of CDI's Contractor Quality Control Work Plan is also included in Appendix F. The means and methods for daily clean up, area restoration, handling of waste , debris and/or fill materials encountered along the alignment are presented in these plans, together with the sequencing of the work.. We are unaware of any special utility or access arrangements which will be required other than those outlined in the ACS site access requirements, which were listed in the project specifications.

SBW Construction Personnel

The specifications require that the design report include the resume of key personnel assigned to this project. This information was previously submitted with the bid package and will not be reproduced here.

Contractor Health and Safety Plan

The CDI Contractor health and Safety Plan has been included herewith as Appendix G.

Special construction Details

It will be necessary to extend the SBW to the perimeter barrier wall alignment. Where slurry walls intersect, the typical method of connection is to simply excavate through the existing soil – bentonite wall and placed newly mixed soil – bentonite at the connection. In this instance, however, the perimeter barrier wall contains a 60 mil HDPE vertical liner which will be severely damaged and its integrity destroyed if the trencher excavates through the liner. Excavating to expose the liner will require extensive dewatering and the installation of trench boxes on both sides of the liner in order to expose the face of the membrane so that a short section of membrane could be connect perpendicular to the face of the perimeter wall membrane. It is likely the membrane will be damage by the excavating process with heavy equipment. The existing soil-bentonite wall materials will be very soft and likely to flow into the excavation, regardless of how the excavation is supported, resulting in the loss of perimeter wall section along the perimeter wall alignment, both north and south of the connection point. Due to the potential risk of damage and breeching of the perimeter wall system, it is not recommended that the membrane be exposed and connection to it be attempted. It is recommend that at the east and west end of the SBW, the trencher be stopped at a distance of approximately 3 feet from the face of the existing wall ~~and then a space between the walls be completed by turning the trencher parallel to the perimeter wall and connecting the~~ soil-bentonite ~~portions of the two walls by making two trencher passes to fill in the gap.~~ A detail of this termination method is presented in Appendix ~~H~~ I.

Another special consideration is the means and methods required to seal subsurface utility penetrations through the SBW. The present concept is to temporarily cut and cap existing utility piping on either side of the SBW alignment prior to reaching them with the trencher. It is understood that the utilities that cross the SBW alignment are all shallow. After the trencher has passed, road plates should be driven perpendicular to the soil-bentonite filled trench on either side of the utility crossing. The soil area between the two plates may then be excavated, bracing the plates as necessary, and the utility re-connected. An anti-seep collar should extend at least 2 feet all around the utility pipe or conduit. The excavated trench should then be backfilled with soil-bentonite slurry mixed in a steel muck box with a backhoe until a slump of approximately 8 inches is achieved. After the soil-bentonite is in place, the plates should be extracted. Details for this type of crossing are also included in Appendix H.

Soil – Bentonite Separation Barrier Wall Specifications

Specifications for the construction of the soil-bentonite separation wall have been prepared and are presented herewith as Appendix ~~I~~ J.

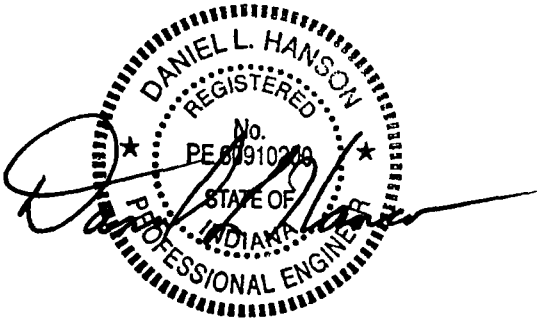
H.

This report and the SBW mix design have been prepared under the direction of this writer, who is a Licensed Professional Engineer in the State of Indiana. The SBW thickness and depth of penetration into the silty clay deposits underlying the site have been determined by this writer. The wall alignment and termination locations have been determined based on information provided by others. If the Separation Barier Wall is constructed as outlined in the test of this report, it is my conclusion that the wall will meet the objectives indicated.

It is hoped that this information is sufficient to fulfill your present requirements. Should you have any questions or require additional information, please do not hesitate to call.

Respectfully submitted,
HANSON ENGINEERING, P.C.

Daniel L. Hanson, P.E.
Principal Engineer



APPENDIX A

JLT J&L TESTING COMPANY, INC.
GEOTECHNICAL AND GEOSYNTHETICS MATERIALS TESTING AND RESEARCH

January 31, 1997
96M2059-01

Horizontal Technologies
2309 Hancock Bridge Parkway
Cape Coral, FL 33990

Attn: Greg Rawl, P.G.

FINAL REPORT
BACKFILL MIX DESIGN AND COMPATIBILITY
AND
GEOMEMBRANE SEAM EVALUATION
AMERICAN CHEMICAL SERVICE, INC. NPL SITE
GRIFFITH, INDIANA PROJECT

Dear Mr. Rawl:

J&L Testing Company, Inc. (JLT) is pleased to submit this final report of the work performed to prepare a soil-bentonite backfill design mix, evaluate the anticipated performance of a soil-bentonite backfill mix per EPA 9100 test protocols, and perform an integrity evaluation of the proposed geomembrane joint and liner that will be a part of an HDPE barrier wall to be installed in a cutoff trench at the American Chemical Service NPL Site, Griffith, Indiana. Section 1 discusses the scope of work, Section 2 describes the materials of evaluation. Section 3 describes the mix design work, Section 4 describes the compatibility testing performed on the soil-bentonite mix, Section 5 describes the geomembrane test program, and Section 6 presents our evaluation of the laboratory data.

1.0 SCOPE OF WORK

The scope of work for this project was to (1) determine the optimum mix design using on-site soils and imported commercial bentonite to create a backfill material that would exhibit an inplace permeability of $\leq 1 \times 10^{-7}$ cm/sec with on-site water as the permeant, and (2) evaluate the performance of the proposed HDPE geomembrane connection joint system with a hydrophilic joint sealer in a site water environment. Each is discussed in more detail below.

1.1 Backfill Materials

The first phase of work included preparation of potential backfill mixes using on-site soils with varying bentonite contents to determine the optimum mix which would

yield a permeability of $\leq 1 \times 10^{-7}$ cm/sec (ASTM D-5084). Once the optimum backfill mix was determined, the mix was repeated to verify its properties and a sample was also subjected to EPA 9100 compatibility testing using site water as the permeant with permeability monitored over a period of time equal to the inflow of at least 3 pore volumes.

1.2 Geomembrane Seam Testing

Three (3) HDPE geomembrane seams were fabricated and fitted with a hydrophilic sealer rod supplied by Horizontal Technologies. These joints were then subjected to the site water and tap water under 5, 10 and 15 psi differential pressures to determine the effectiveness of the seal and the potential leakage rate through joints. The 15 psi pressure equates to approximately 25 feet of water head, which is the pressure the geomembrane joint may be exposed to if the interior of the barrier wall is fully dewatered. A similar joint with rivetted stainless steel stiffening rods and a hydrophilic seal between the rods and geomembrane were also tested to evaluate the seal around the rivets.

2.0 MATERIALS OF EVALUATION

The materials used for this project included the following:

2.1 Site Water

Samples of site water were collected by Foster Wheeler from monitoring wells No. 3 and No. 16 by first purging the well of three (3) pore volumes and then pumping the groundwater into mason jars. Samples of these sealed glass jars labeled as No. 3 and No. 16 were then shiped in coolers with ice packs to JLT for this test program. These jars were kept sealed and refrigerated until they were used. For this test program, a 50:50 mixture of the this site water (as directed by Horizontal Technologies) was prepared for all tests. The mixture was prepared by compositing one (1) quart jar of each water sample for use as the permeant fluid for the EPA 9100 test. Prior to performing the mix designs, one quart of the 50:50 mix was also prepared, packaged and shipped on ice to Ameritest & Research Company, Inc. of Belford Heights, Ohio for analytical testing. The results of these tests are presented in Appendix A. The test parameters for this analysis were supplied by Horizontal Technologies.

2.2 Soil

Twenty-six (26) soil borings were installed in the area of the barrier wall. Soil

samples were then composited over the depth of the borings from the sand and clay strategraphic units. Each sand and clay composite was further composited with other boring composites which resulted in one (1) 5-gallon sand and one (1) 5-gallon clay composite. The sand composite sample was shipped to JLT for the test program.

2.3 Geomembrane

Samples of the geomembrane joint elements and a sample of the hydrophilic joint sealer were shipped to JLT from Horizontal Technologies. JLT then had the regional office of National Seal Company (NSC) in Wexford, PA weld 60 mil NSC HDPE geomembrane panels to the joints per USEPA criteria so that appropriate coupons could be fabricated for testing. These welded joints were vacuum tested by JLT's technicians prior to use to verify seam integrity. The joint with the stainless steel stiffening bars arrived fully fabricated and only required trimming for the test.

2.4 Bentonite

The bentonite used for this test program is identified as HYDROGEL 90 and was supplied to JLT from Wyo-Ben, Inc., Billings, Montana. A copy of the identification label and material specifications are included in Appendix B.

2.5 Tap Water

Tap water used for the work was provided by JLT as supplied to JLT by the Pennsylvania American Water Company.

3.0 MIX DESIGN

As part of the mix design, the soil was first tested to determine its physical properties, namely gradation (ASTM D-422) and specific gravity (ASTM D-854). Results are presented in Appendix B. The soil is classified as a brown silty sand (SP-SM) with a specific gravity of 2.65. The grainsize was used as a means to estimate the percent bentonite, on a dry weight basis, necessary to add to achieve the desired permeability. The specific gravity was used for various calculations such as the determination of void ratio, degree of saturation and pore volume.

As originally proposed, it was decided to use a high slump backfill to prevent the material from arching in the narrow cutoff trench. Consequently, the mix design was focused on creating a suitable backfill with a high slump of approximately eight (8) inches. The mix design was performed as follows.

Based on our evaluation of the grainsize curve, it was estimated that about 3% bentonite would be required to achieve a permeability of about $1x10^{-7}$ cm/sec. Therefore, we elected to prepare 2, 3 and 4% bentonite content (by dry weight basis) mixes to span this initial estimate.

HYDROGEL 90 bentonite was selected based on JLT's experience with this product and its availability to Horizontal Technologies. The bentonite was prepared in slurry form with tap water using a standard shear mixer per API standards to create a bentonite fluid slurry for mixing with the on-site sand sample. The results of the basic physical properties of these slurries were:

Mixture % Bentonite	Density (g/cc)	Marsh Funnel (sec)
2	1.02	35
3	1.03	37
4	1.04*	40

* Slightly less than 1.04

Each mix was then blended with the on-site sand to create a test backfill mix with a suitable slump (=8 in.) and consistency for the project having a bentonite content (by dry weight basis) of 2, 3, and 4%.

% Bentonite	Mix Slump (inches) (ASTM C-143)
2	8-
3	8
4	8+

Note: Due to the narrow width of the trench, a high slump backfill was selected for the design to preclude the possibility of side wall arching.

Samples of these mixes were then placed in a Trautwein rigid wall slurry forming device and allowed to consolidate under an effective pressure of 6 psi for 24 hours. The formed samples were then removed and the weight, height and diameter were recorded. The sample was then placed in a flex-wall permeability device (ASTM D-5084) and allowed to consolidate under the following pressures.

Cell Pressure = 50 psi
Headwater = 42 psi
Tailwater = 38 psi

The systems were then monitored until the following parameters were achieved.

Volume Change	=	0
Inflow	=	Outflow
Skempton's B-parameter	≥	0.96

Results of these three (3) flex-wall permeability tests using tap water as the mix water and permeant are presented in Appendix C. The results are plotted on Figure 1 and summarized below.

Percent Bentonite	Permeability (cm/sec)
2%	1.38×10^{-7}
3%	9.22×10^{-8}
4%	1.53×10^{-8}

Based on these results, it was determined that a bentonite content of approximately 3.5% would have been satisfactory to achieve a permeability $\leq 1 \times 10^{-7}$ cm/sec. However, not knowing the variation in material characteristics (principally the grainsize consist of the material) along the entire trench, it was concluded that a 4% bentonite content would be a more conservative design recipe for the backfill.

To reverify this mix, a second independent batch with 4% bentonite (by dry weight basis) was prepared and the material retested. The results of the verification test are also presented in Appendix C. The permeability of the verification mix was 1.98×10^{-8} cm/sec. Once comfortable with the performance of the design mix with 4% bentonite and tap water, the design mix was finalized for EPA 9100 compatibility testing.

4.0 EPA 9100 COMPATIBILITY TEST

A third batch of 4% bentonite mix was prepared using on-site sand and tap water, and this sample was also placed in the Trautwein rigid wall cell for forming and then into the Boart Longyear flex-wall permeability device. The sample was allowed to consolidate under the following pressures.

Cell Pressure	=	50 psi
Headwater	=	42 psi
Tailwater	=	38 psi

This yielded a gradient of 30 across the sample. The system was monitored until the following parameters were achieved.

Volume Change	=	0
Inflow	=	Outflow
Skempton's B-parameter	≥	0.96

A schematic of the compatibility testing equipment configuration is presented on Figure 2. On September 5, 1996, equilibrium conditions were fulfilled using tap water as the permeant and the test was continued with tap water until September 13, 1996 when the final baseline permeability with tap water as the permeant was determined ($k=2.68 \times 10^{-8}$) cm/sec. On September 13, 1996, the unit was converted to accept the 50:50 mix of site water using the system shown on Figure 2. This commenced the start of EPA 9100 compatibility testing.

Prior to this testing, the initial dimensions and weight of the sample were recorded. Using the weighted specific gravity (SpG = 2.68) of the combined soil (SpG = 2.65) and bentonite (SG = 2.75), the estimated initial pore volume of 140 cm^3 was computed. This was the pore volume used to compute the pore volume of liquid that entered the sample. Calculations are presented in Appendix D.

At periodic intervals, the flow, elapsed time and temperature of the water were recorded and the permeability and pore volume computed based on these original dimensions of the sample. The results are plotted versus elapsed time on Figures 3 and 4. On the 56th day, JLT was instructed to increase the gradient to about 50 to accelerate the test. To achieve this gradient, the pressures were set as follows using the initial dimensions of the sample to establish the gradient.

Cell Pressure	=	50 psi
Headwater	=	43.1 psi
Tailwater	=	36.9 psi
Gradient (Becomes)	=	50.18 based on initial dimensions

By inspection of the data plot (Figure 3), the fluctuation in the permeability plot between day 56 and day 66 is a reflection of this gradient change. The sample also consolidated with a 0.1 ml volume change which we deemed insignificant. Approximately 10 days were required (as expected) for the sample to reachieve equilibrium. The test continued until 3+ pore volumes of site water entered the sample based on the initial calculation of pore volume (140 cm^3). As a matter of note, it is assumed the first pore volume of site water displaced the tap water fluid in the sample, and that the first and second pore volume ultimately passed through the sample, leaving the third pore volume of site water in the sample at the time of test termination. Individual data reductions for each point on these curves (Figures 3 and 4) are presented in Appendix E.

Once the system was disassembled, the final dimensions, density and moisture content were determined and the final permeability and gradient were computed based on these final dimensions for the last data point. These results are presented in Appendix E and summarized below.

DAY 98 FINAL PARAMETERS	
Permeability	2.45×10^{-8} cm/sec
Final Height	3.24 in.
Final Diameter	2.68 in.
Final Moisture Content	19.98%
Final Dry Density	114.5 pcf
Actual Final Gradient	52.81

Using these final measurements, the actual pore volume of the sample during the test was determined and the corrected pore volume vs. time and permeability vs. time were replotted for the entire test. Calculations are presented in Appendix D. These adjusted final pore volume flows and permeability curves are presented on Figures 5 and 6.

5.0 GEOMEMBRANE SEAM TESTING

To evaluate the performance of the hydrophilic seal in the geomembrane joint, three (3) 12-inch diameter specimens were prepared with the joint oriented along the diameter of the specimen. The joints were fitted with the hydrophilic rod and placed in a 12-inch diameter rigid wall test apparatus. Figure 7 shows a cross section of the joint and Figure 8 shows a schematic of the test apparatus. The circular specimen edge adjacent to the test chamber was sealed with a silicone seal and bitumastek joint sealer to prevent side wall leakage.

For one sample, 2 to 3 inches of tap water was placed on the upper side of the specimen to serve as a control sample. The two (2) other samples were covered with 2 to 3 inches of the 50:50 site water as the test samples.

A 5 psi pressure was applied to each of the water surfaces while the under side of the specimens were allowed to drain to atmosphere into a collection system. This 5 psi pressure on all three (3) samples was applied from August 15, 1996 until August 19, 1996 (4 days). No leakage was observed from any of the test units.

On August 19, 1996, the pressure was increased to 10 psi until August 26, 1996 (7 days). Again, no leakage was observed.

On August 26, 1996, the pressure was increased to 15 psi and remained at this pressure until September 17, 1996 (21 days). Again, no leakage was observed through any of the specimens.

On that date, JLT was instructed by Horizontal Technologies to terminate testing of the specimen using tap water and to terminate one test specimen using the site water. The last site water test continued until December 19, 1996 (a total of 114 days at 15 psi). Once again, no leakage occurred through the system. At this point, Horizontal Technologies requested that the pressure be increased to determine if leakage would occur at higher pressures. The applied pressure was increased in 5 psi increments for a period of 48 hours (20 psi, 25 psi and 30 psi). At 30 psi, the seal adjacent to the edge of the sample failed. No leakage occurred through the joint. A photograph of this test sample cross section and a photograph of the hydrophilic seal before and after free swell hydration are presented in Appendix F.

The prefabricated seam with the stainless steel stiffening rods was also subjected to seam testing similar to the first specimens. A section of this specimen is presented on Figure 7A. The specimen was fitted into the test chamber and 2 inches of the 50:50 site water was placed over the specimen under a 2 psi load for a period of two (2) days to hydrate the system. It is noted that no leakage occurred during this test period. A 15 psi pressure was then applied and held at this level for ten (10) days. During this period, no leakage occurred and the system was disassembled.

6.0 CONCLUSIONS

Our conclusions, based on the results of this testing program, are summarized herein.

6.1 Mix Design and Compatibility

The 4% HYDROGEL 90 bentonite content (by dry weight basis) design mix selected for this project demonstrated a permeability of about $2x10^{-8}$ cm/sec with de-aired tap water as the permeant for both the original design mix and verification mix. When this mix was exposed to the 50:50 mixture (50% No. 3 groundwater and 50% No. 16 groundwater) of site groundwater per EPA 9100 protocols, the long term permeability averaged $3.5x10^{-8}$ cm/sec. This long term EPA 9100 test included 98 days of exposure and the entrance of 4.01 pore volumes of permeant fluid with about 3.01 pore volumes actually passing through the sample. During this 98 day period, the permeability remained consistent with normal fluctuations between data points which can be attributed, at least in part, to typical temperature fluctuations in the laboratory and the inherent accuracy of the equipment.

There was no evidence found in the data to suggest that the site groundwater had an adverse affect on the material's hydraulic conductivity properties under these conditions.

This design is predicated on the thorough mixing of the materials and does provide some allowance for soil variability. Should the field Construction Qaulity Assurance

(CQA) testing of the sand show gap graded materials. more poorly graded materials or the percent passing the #200 sieve below 6%. verification hydraulic conductivity performance tests should be performed to reverify the design mix performance.

It is assumed the Designer/Certifying Engineer has established a CQA testing program for the project which includes, as a minimum, the following:

- Periodic grainsize analysis of the sand (ASTM D-422)
- Periodic sampling of the insitu backfill materials for gradation (ASTM D-422) and hydraulic conductivity (ASTM D-5084)
- Field Slump Testing (ASTM C-143)

6.2 Geomembrane Seam Test

Throughout the test using differential pressures of 5, 10 and 15 psi across the seam, there was no leakage observed through the geomembrane joint or through the rivetted stainless steel bar joints. This data demonstrates that the hydrophilic rod did expand when exposed to site water and did create an effective hydraulic seal in the joints to prevent the transport of fluid through the joint. There was no evidence found to suggest that the site water had an adverse affect on the hydrophilic seal.

Sincerely,

J&L TESTING COMPANY, INC.

John Boschuk, Jr., P.E., BEP
Technical Consultant

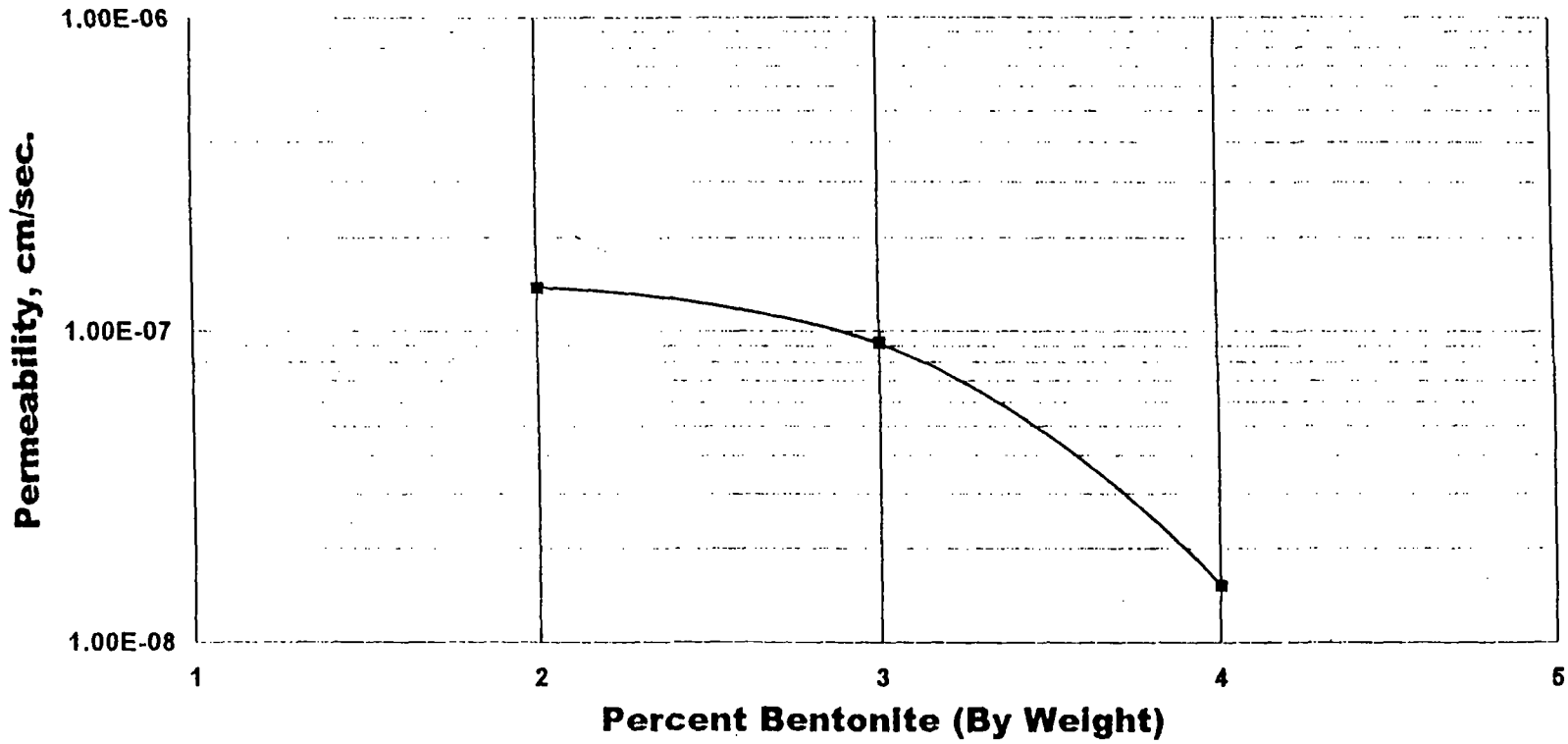
Enclosures
JB/rdg
\wpwin60\letter\9727

FIGURE 1

PERMEABILITY VS % BENTONITE

MIX DESIGN RESULTS

AMERICAN CHEMICAL NPL SITE BARRIER WALL



FLEX–WALL SOIL/FLUID COMPATABILITY APPARATUS SCHEMATIC

EPA 9100 / ASTM D-5084

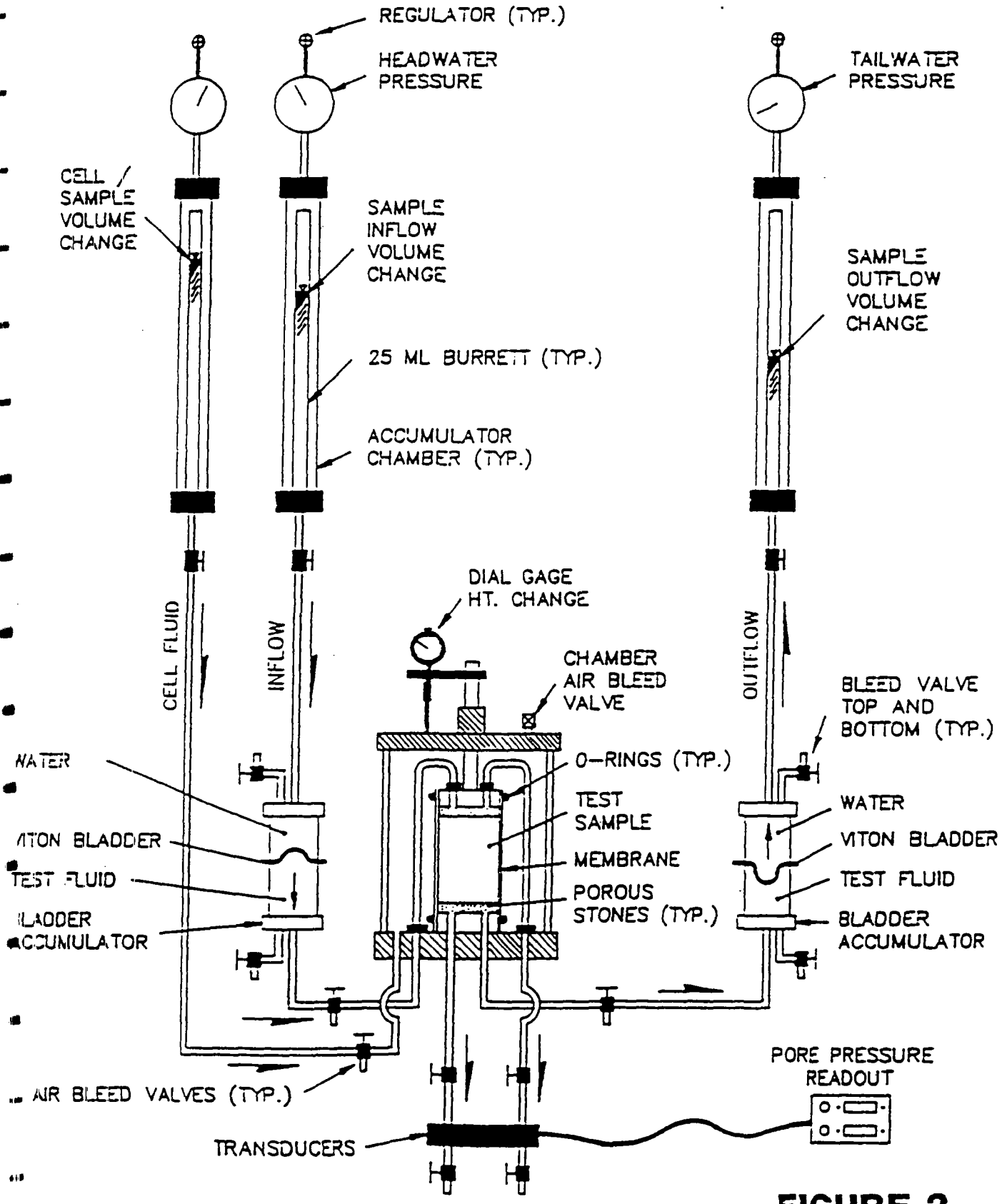
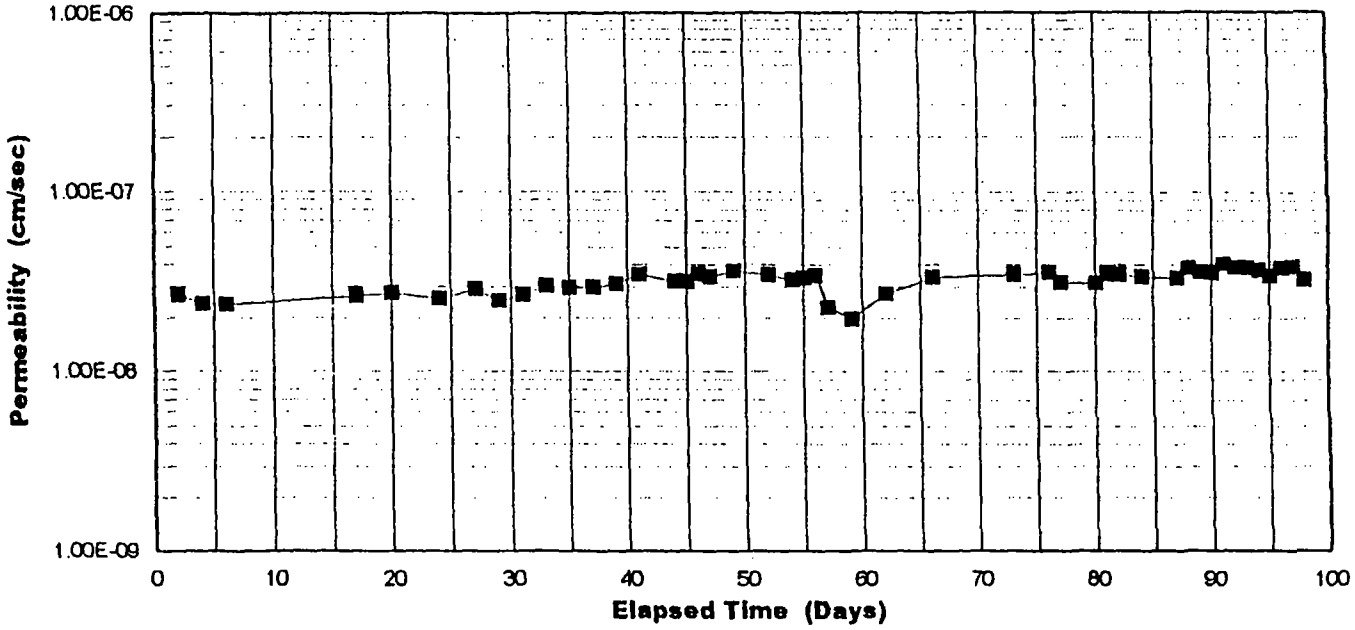


FIGURE 2

J & L Testing Company, Inc.

EPA 9100 TESTING
AMERICAN CHEMICAL SERVICE NPL SITE

PERMEABILITY vs ELAPSED TIME
4% BENTONITE & SITE WATER



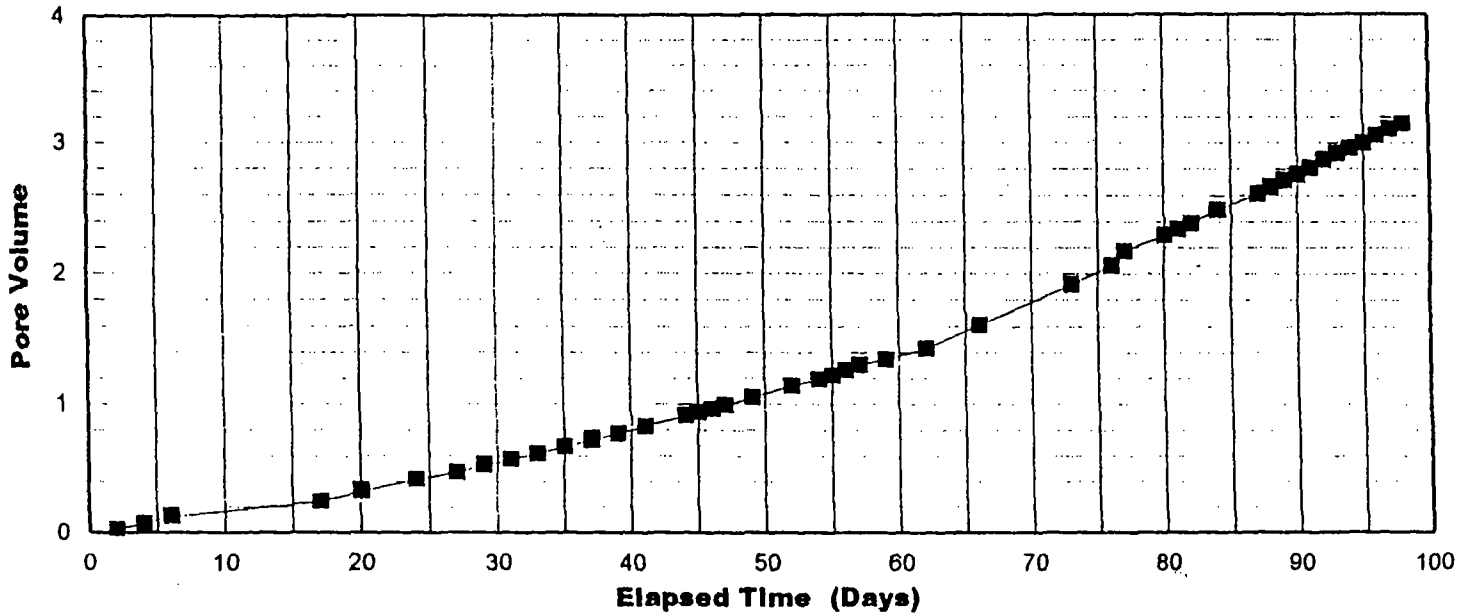
NOTE : Data is based on initial dimensions of sample

FIGURE 3

J & L Testing Company, Inc.

EPA 9100 TESTING
AMERICAN CHEMICAL SERVICE NPL SITE

PORE VOLUME vs ELAPSED TIME
4% BENTONITE & SITE WATER



NOTE: Data is based on initial dimensions of sample

FIGURE 4

J & L TESTING COMPANY, Inc.

EPA 9100 TESTING

AMERICAN CHEMICAL SERVICE NPL SITE

PERMEABILITY VS ELAPSED TIME
4% BENTONITE - SITE WATER

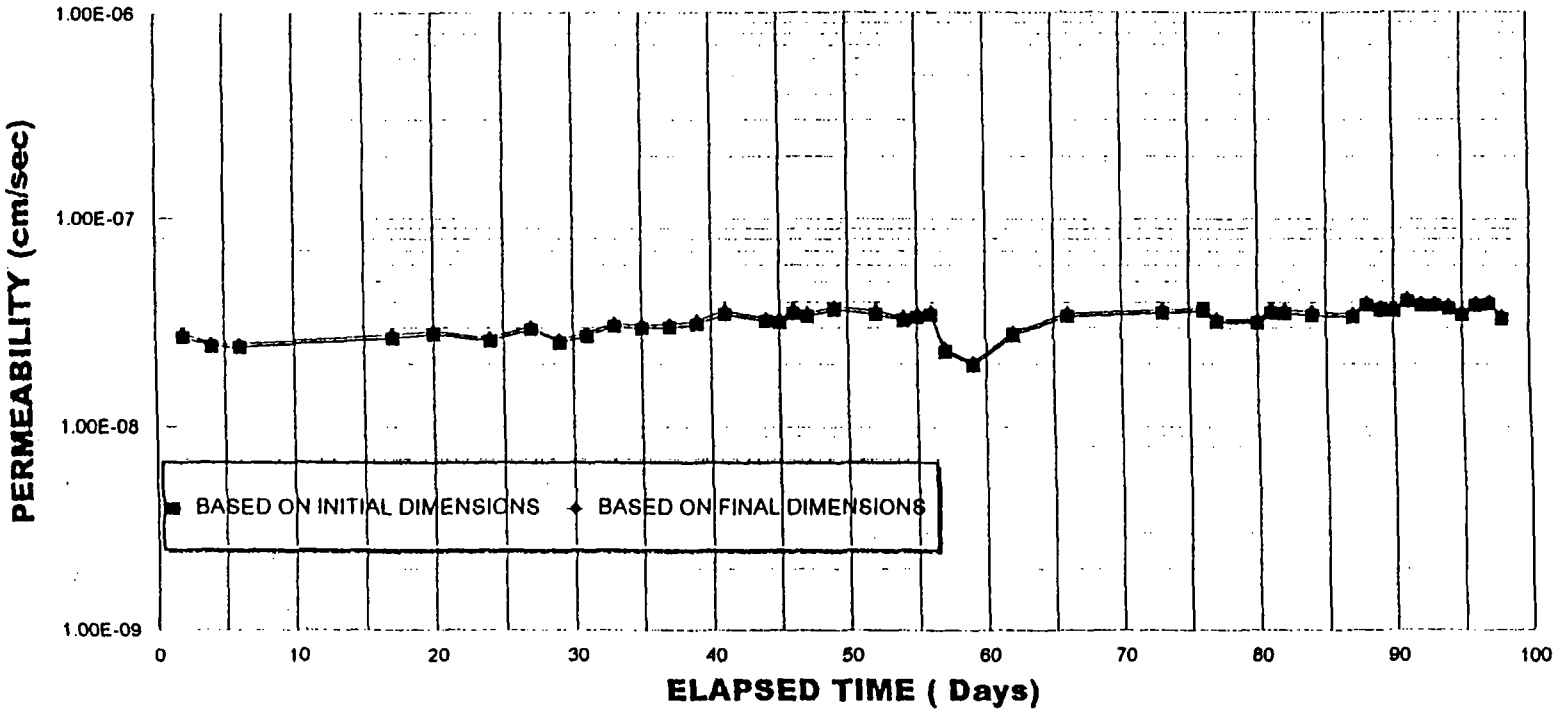


FIGURE 5

J & L Testing Company, Inc.

EPA 9100 TESTING

AMERICAN CHEMICAL SERVICE NPL SITE

PORE VOLUME VS ELAPSED TIME
4% BENTONITE - SITE WATER

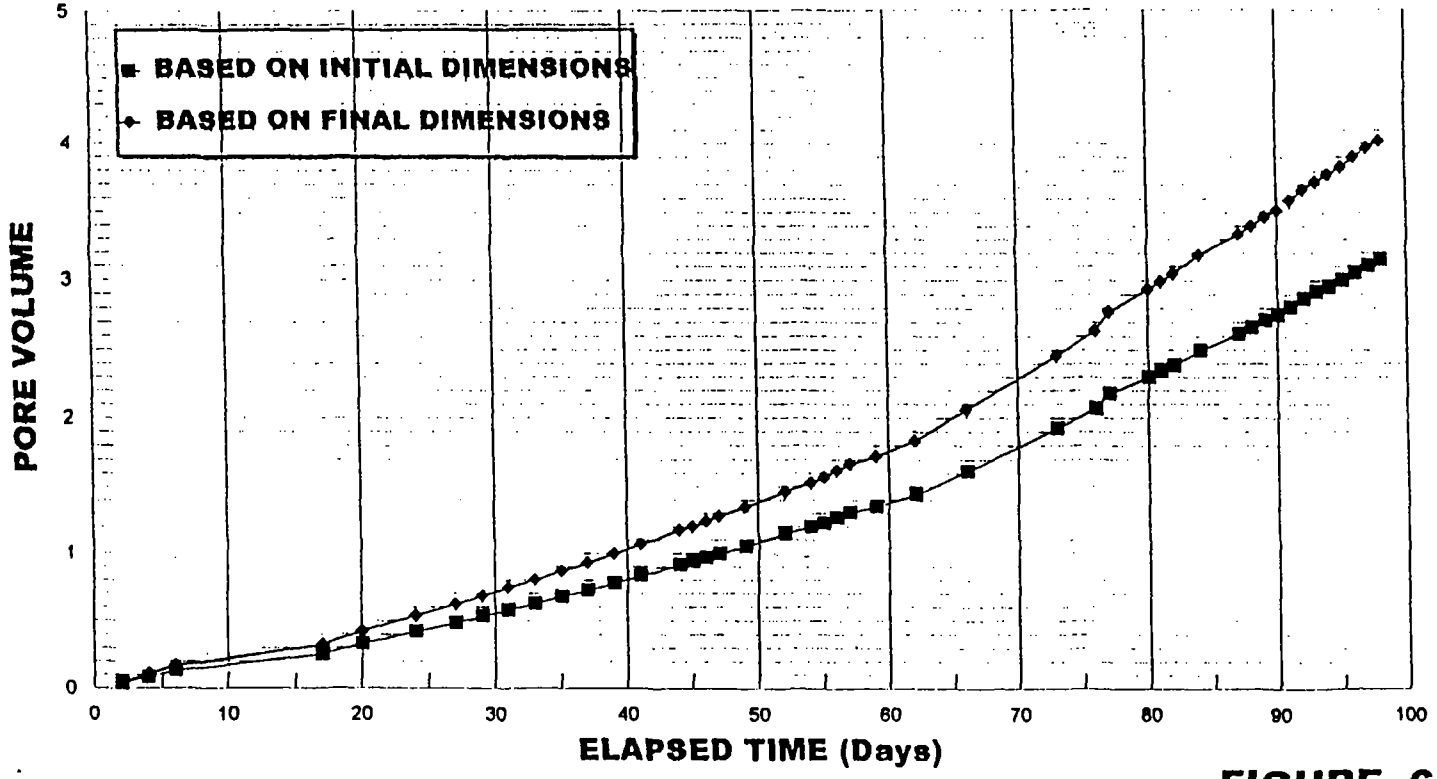


FIGURE 6

APPENDIX B

TABLE 1

CONTAMINANT CONCENTRATIONS IN GROUNDWATER (CONTINUED)

Constituents	Units	Concentration Range Detected	Expected Concentration
Cations (continued)			
Mercury	mg/l	0.0025	0.0007
Nickel	mg/l	0.02 to 2.0	0.2
Potassium	mg/l	6 to 30	10
Selenium	mg/l	0.002	0.002
Sodium	mg/l	NA	NA
Thallium	mg/l	0.0020	0.0019
Zinc	mg/l	0.06 to 160	5
Organics			
Acetone	µg/l	10 to 1,710,000	1,500
Benzene	µg/l	300 to 9,600,000	2,500
bis(2-Chloroethyl)ether	µg/l	10 to 800	20
bis(2-Ethylhexyl)phthalate	µg/l	10 to 320,000	50
2-Butanone	µg/l	10 to 970,000	2,000
Butyl benzyl phthalate	µg/l	10 to 27,000	100
Chloroethane	µg/l	1 to 3,100	600
Chloromethane	µg/l	2 to 2,000	30
4-Chloro-3-methylphenol	µg/l	10	10
1,2-Dichlorobenzene	µg/l	1 to 570,000	200
1,1-Dichloroethane	µg/l	10 to 25,000	500
1,2-Dichloroethane	µg/l	10 to 66,000	78.5
1,1-Dichloroethene	µg/l	1 to 80.0	2.5
1,2-Dichloroethene-cis	µg/l	10 to 75,000	1,317
1,2-Dichloroethene-trans	µg/l	1 to 20.0	27.0
1,2-Dichloropropane	µg/l	1 to 300	4.7
Diethyl phthalate	µg/l	10 to 25,000	40
2,4-Dimethylphenol	µg/l	10 to 3,800	50
Dimethyl phthalate	µg/l	10 to 25,000	20
Di-n-butyl phthalate	µg/l	10 to 65,000	20
Ethylbenzene	µg/l	3 to 6,200,000	300

TABLE 1

CONTAMINANT CONCENTRATIONS IN GROUNDWATER
(CONTINUED)

Constituents	Units	Concentration Range Detected	Expected Concentration
Organics (continued)			
Isophorone	µg/l	10 to 77,000	50
Methylene Chloride	µg/l	50 to 940,000	300
4-Methyl-2-pentanone	µg/l	10 to 2,900,000	500
4-Methylphenol	µg/l	10 to 560	20
Naphthalene	µg/l	2 to 2,400,000	50
Phenol	µg/l	10 to 17,000	200
Tetrachloroethene	µg/l	10 to 35,200,000	500
Tetrahydrofuran	µg/l	10 to 4,000	20
Toluene	µg/l	300 to 31,400,000	1,000
1,1,1-Trichloroethane	µg/l	10 to 15,000,000	1,000
Trichloroethene	µg/l	10 to 7,600,000	1,000
Trichlorofluoromethane	µg/l	1 to 130,000	10
Vinyl chloride	µg/l	1 to 26,000	100
Xylenes, total	µg/l	5 to 35,000,000	1,000

NA Not available.

APPENDIX C

TABLE 1

CONTAMINANT CONCENTRATIONS IN GROUNDWATER (CONTINUED)

Constituents	Units	Concentration Range Detected	Expected Concentration	
Cations (continued)				
Mercury	mg/l	0.0025	0.0007	—
Nickel	mg/l	0.02 to 2.0	0.2	0.032
Potassium	mg/l	6 to 30	10	23
Selenium	mg/l	0.002	0.002	ND
Sodium	mg/l	NA	NA	86
Thallium	mg/l	0.0020	0.0019	ND
Zinc	mg/l	0.06 to 160	5	ND
Organics				
Acetone	µg/l	10 to 1,710,000	1,500	13,000
Benzene	µg/l	300 to 9,600,000	2,500	7900
bis(2-Chloroethyl)ether	µg/l	10 to 800	20	320
bis(2-Ethylhexyl)phthalate	µg/l	10 to 320,000	50	ND
2-Butanone	µg/l	10 to 970,000	2,000	16,000
Butyl benzyl phthalate	µg/l	10 to 27,000	100	ND
Chloroethane	µg/l	1 to 3,100	600	370
Chloromethane	µg/l	2 to 2,000	30	ND
4-Chloro-3-methylphenol	µg/l	10	10	ND
1,2-Dichlorobenzene	µg/l	1 to 570,000	200	ND
1,1-Dichloroethane	µg/l	10 to 25,000	500	3400
1,2-Dichloroethane	µg/l	10 to 66,000	78.5	1800
1,1-Dichloroethene	µg/l	1 to 80.0	2.5	56
1,2-Dichloroethene-cis	µg/l	10 to 75,000	1,317	5300
1,2-Dichloroethene-trans	µg/l	1 to 20.0	27.0	ND
1,2-Dichloropropane	µg/l	1 to 300	4.7	130
Diethyl phthalate	µg/l	10 to 25,000	40	ND
2,4-Dimethylphenol	µg/l	10 to 3,800	50	3300
Dimethyl phthalate	µg/l	10 to 25,000	20	ND
Di-n-butyl phthalate	µg/l	10 to 65,000	20	—
Ethylbenzene	µg/l	3 to 6,200,000	300	890

TABLE 1

CONTAMINANT CONCENTRATIONS IN GROUNDWATER (CONTINUED)

Constituents	Units	Concentration Range Detected	Expected Concentration	
Organics (continued)				
Isophorone	µg/l	10 to 77,000	50	NO
Methylene Chloride	µg/l	50 to 940,000	300	7200
4-Methyl-2-pentanone	µg/l	10 to 2,900,000	500	11,000
4-Methylphenol	µg/l	10 to 560	20	6400
Naphthalene	µg/l	2 to 2,400,000	50	NO
Phenol	µg/l	10 to 17,000	200	1900
Tetrachloroethene	µg/l	10 to 35,200,000	500	50
Tetrahydrofuran	µg/l	10 to 4,000	20	—
Toluene	µg/l	300 to 31,400,000	1,000	8800
1,1,1-Trichloroethane	µg/l	10 to 15,000,000	1,000	860
Trichloroethene	µg/l	10 to 7,600,000	1,000	230
Trichlorofluoromethane	µg/l	1 to 130,000	10	—
Vinyl chloride	µg/l	1 to 26,000	100	370
Xylenes, total	µg/l	5 to 35,000,000	1,000	1200

NA Not available.

[redacted] INTERNATIONAL

SIMALABS International

Date: *Thursday, November 30, 2000*

CLIENT: C.D.S., Inc.
Project: ACS-Griffith
Lab Order: ME0011268
Date Received: 11/21/00

Work Order/ Sample Delivery Group Summary

Lab Sample ID	Client Sample ID	Client Description	Collection Date
ME0011268-01A	Influent	Influent	21-Nov-00
ME0011268-01B	Influent	Influent	21-Nov-00
ME0011268-01C	Influent	Influent	21-Nov-00

150 West 84th Drive, Merrillville, IN 46410 TEL.800.536.9379 TEL.219.769.8378 FAX 219.769.1664

[redacted] INTERNATIONAL

ANALYTICAL RESULTS

Date: *Thursday, November 30, 2000*

Client:	C.D.S., Inc.	***Client Project:***	ACS-Griffith
		Work Order:	ME0011268
Client Sample ID:	Influent	***SIMALABS ID:***	ME0011268-01A
Sample Description:	Influent		
Sample Matrix:	Aqueous		
Collection Date:	11/21/00		
Date Received:	11/21/00		

Analyses	Samp Type	Result	Reporting Limit	Qual	Units	DF	Date Analyzed
SEMIVOLATILE ORGANICS		Method: SW8270C		Prep Date: 11/27/00		Analyst: NT	
Total Cresol	A	ND	110		µg/L	10	11/29/00
Acenaphthene	A	ND	110		µg/L	10	11/29/00
Acenaphthylene	A	ND	110		µg/L	10	11/29/00
Aniline	A	ND	110		µg/L	10	11/29/00
Anthracene	A	ND	110		µg/L	10	11/29/00
Benzidine	A	ND	550		µg/L	10	11/29/00
Benzo[a]anthracene	A	ND	110		µg/L	10	11/29/00
Benzo[a]pyrene	A	ND	110		µg/L	10	11/29/00
Benzo[b]fluoranthene	A	ND	110		µg/L	10	11/29/00
Benzo[g,h,i]perylene	A	ND	110		µg/L	10	11/29/00
Benzo[k]fluoranthene	A	ND	110		µg/L	10	11/29/00
Benzoic acid	A	ND	550		µg/L	10	11/29/00
Benzyl alcohol	A	ND	220		µg/L	10	11/29/00
Butyl benzyl phthalate	A	ND	110		µg/L	10	11/29/00
4-Bromophenyl phenyl ether	A	ND	110		µg/L	10	11/29/00
Di-n-butyl phthalate	A	ND	110		µg/L	10	11/29/00
4-Chloro-3-methylphenol	A	ND	220		µg/L	10	11/29/00
4-Chloroaniline	A	ND	220		µg/L	10	11/29/00
Bis(2-chloroethoxy)methane	A	ND	110		µg/L	10	11/29/00
Bis(2-chloroethyl)ether	A	330	110		µg/L	10	11/29/00
Bis(2-chloroisopropyl)ether	A	ND	110		µg/L	10	11/29/00
2-Chloronaphthalene	A	ND	110		µg/L	10	11/29/00
2-Chlorophenol	A	ND	110		µg/L	10	11/29/00
4-Chlorophenyl phenyl ether	A	ND	110		µg/L	10	11/29/00
Chrysene	A	ND	110		µg/L	10	11/29/00
Dibenz[a,h]anthracene	A	ND	110		µg/L	10	11/29/00
Dibenzofuran	A	ND	110		µg/L	10	11/29/00
1,3-Dichlorobenzene	A	ND	110		µg/L	10	11/29/00
1,4-Dichlorobenzene	A	ND	110		µg/L	10	11/29/00
1,2-Dichlorobenzene	A	ND	110		µg/L	10	11/29/00
3,3'-Dichlorobenzidine	A	ND	550		µg/L	10	11/29/00
2,6-Dichlorophenol	A	ND	110		µg/L	10	11/29/00
2,4-Dichlorophenol	A	ND	110		µg/L	10	11/29/00
Diethyl phthalate	A	ND	110		µg/L	10	11/29/00

Samp Type: A - Analyte, S - Surrogate, I - Internal Standard
Qual: ND - Not Detected at the Reporting Limit; B - Detected in the associated Method Blank; E - Exceeds calibration maximum; DF - Dilution Factor; S - Spike recovery outside recovery limits; SC - Inac dilution; R - RPD outside accepted recovery limits; B - Value above quantitation range; I - Interna interference

Preliminary

250 West 84th Drive, Merrillville, IN 46410 TEL.800.536.8379 TEL.219.769.8378 FAX 219 769 1664

[redacted]
INTERNATIONAL

ANALYTICAL RESULTS

Date: *Thursday, November 30, 2000*

Client:	C.D.S., Inc.	*Client Project:*	ACS-Griffith
		Work Order:	ME0011268
Client Sample ID:	Influent	*SIMALABS ID:*	ME0011268-01A
Sample Description:	Influent		
Sample Matrix:	Aqueous		
Collection Date:	11/21/00		
Date Received:	11/21/00		

Analytes	Samp Type	Result	Reporting Limit	Qual	Units	DF	Date Analyzed
Dimethyl phthalate	A	ND	110		µg/L	10	11/29/00
2,4-Dimethylphenol	A	9300	550		µg/L	50	11/30/00
4,6-Dinitro-2-methylphenol	A	ND	550		µg/L	10	11/29/00
2,4-Dinitrophenol	A	ND	550		µg/L	10	11/29/00
2,6-Dinitrotoluene	A	ND	110		µg/L	10	11/29/00
2,4-Dinitrotoluene	A	ND	110		µg/L	10	11/29/00
Bis(2-ethylhexyl)phthalate	A	ND	110		µg/L	10	11/29/00
Fluoranthene	A	ND	110		µg/L	10	11/29/00
Fluorene	A	ND	110		µg/L	10	11/29/00
Hexachlorobenzene	A	ND	110		µg/L	10	11/29/00
Hexachlorobutadiene	A	ND	110		µg/L	10	11/29/00
Hexachlorocyclopentadiene	A	ND	110		µg/L	10	11/29/00
Hexachloroethane	A	ND	110		µg/L	10	11/29/00
Indeno(1,2,3cd)pyrene	A	ND	110		µg/L	10	11/29/00
Isophorone	A	ND	110		µg/L	10	11/29/00
2-Methylnaphthalene	A	ND	110		µg/L	10	11/29/00
3/4-Methylphenol	A	6400	550		µg/L	50	11/30/00
2-Methylphenol	A	1500	110		µg/L	10	11/29/00
Naphthalene	A	ND	110		µg/L	10	11/29/00
4-Nitroaniline	A	ND	550		µg/L	10	11/29/00
2-Nitroaniline	A	ND	550		µg/L	10	11/29/00
3-Nitroaniline	A	ND	550		µg/L	10	11/29/00
Nitrobenzene	A	ND	110		µg/L	10	11/29/00
4-Nitrophenol	A	ND	550		µg/L	10	11/29/00
2-Nitrophenol	A	ND	110		µg/L	10	11/29/00
N-Nitrosodi-n-propylamine	A	ND	110		µg/L	10	11/29/00
N-Nitrosodiphenylamine	A	ND	110		µg/L	10	11/29/00
Di-n-octyl phthalate	A	ND	110		µg/L	10	11/29/00
Pentachlorophenol	A	ND	550		µg/L	10	11/29/00
Phenanthrene	A	ND	110		µg/L	10	11/29/00
Phenol	A	1900	550		µg/L	50	11/30/00
Pyrene	A	ND	110		µg/L	10	11/29/00
Pyridine	A	ND	110		µg/L	10	11/29/00
1,2,4-Trichlorobenzene	A	ND	110		µg/L	10	11/29/00
2,4,5-Trichlorophenol	A	ND	110		µg/L	10	11/29/00

Samp Type: A - Analyte, S - Surrogate, I - Internal Standard
Qual: ND - Not Detected at the Reporting Limit
B - Detected in the associated Method Blank
E - Exceeds Maximum Contaminant Level

DF - Dilution Factor
S - Spike recovery outside recovery limits
SD - Value diluted
R - RPD outside accepted recovery limits
E - Value above quantitation range
I - Matrix Interference

Preliminary

250 West 84th Drive, Merrillville, IN 46410 TEL.800.536.8379 TEL.219.769.8378 FAX 219.769.1664

[redacted]
INTERNATIONAL

ANALYTICAL RESULTS

Date: *Thursday, November 30, 2000*

Client:	C.D.S., Inc.	***Client Project:***	ACS-Griffith
		Work Order:	ME0011268
Client Sample ID:	Influent	***SIMALABS ID:***	ME0011268-01A
Sample Description:	Influent		
Sample Matrix:	Aqueous		
Collection Date:	11/21/00		
Date Received:	11/21/00		

Analyses	Samp Type	Result	Reporting Limit	Qual	Units	DF	Date Analyzed
2,4,6-Trichlorophenol	A	ND	1.0		ug/L	10	11/29/00
Surr: 2-Fluorobiphenyl	S	54	43-116		% REC	10	11/29/00
Surr: 2-Fluorophenol	S	28	21-100		% REC	10	11/29/00
Surr: Nitrobenzene-d5	S	44	35-114		% REC	10	11/29/00
Surr: Phenol-d5	S	21	10-94		% REC	10	11/29/00
Surr: Terphenyl-d14	S	60	33-141		% REC	10	11/29/00
Surr: 2,4,6-Tribromophenol	S	52	10-123		% REC	10	11/29/00

Samp Type: A - Analyte, S - Surrogate, I - Internal Standard
Qual: ND - Not Detected at the Reporting Limit
J - Detected in the associated Method Blank
E - Exceeds Maximum Concentration Level

DF - Dilution Factor
S - Spike recovery outside recovery limits
SD - Value diluted out
R - RPD outside accepted recovery limits
E - Value above quantitation range
I - Matrix Interference

Preliminary

250 West 84th Drive, Merrillville, IN 46410 TEL.800.556.8379 TEL.219.769.8378 FAX 219.769.1664

[redacted] INTERNATIONAL

ANALYTICAL RESULTS

Date: *Thursday, November 30, 2000*

Client:	C.D.S., Inc.	***Client Project:***	ACS-Griffith
		Work Order:	ME0011268
Client Sample ID:	Influent	***SIMALABS ID:***	ME0011268-01B
Sample Description:	Influent		
Sample Matrix:	Aqueous		
Collection Date:	11/21/00		
Date Received:	11/21/00		

Analyses	Samp Type	Result	Reporting Limit	Qual	Units	DF	Date Analyzed
TOTAL METALS BY ICP		Method: SW6010B		Prep Date: 11/28/00			Analyst: JEK
Aluminum	A	ND	0.2		mg/L	1	11/29/00
Antimony	A	ND	0.1		mg/L	1	11/29/00
Arsenic	A	ND	0.1		mg/L	1	11/29/00
Barium	A	0.19	0.01		mg/L	1	11/29/00
Beryllium	A	ND	0.01		mg/L	1	11/29/00
Cadmium	A	ND	0.01		mg/L	1	11/29/00
Calcium	A	280	1		mg/L	1	11/29/00
Chromium	A	0.021	0.01		mg/L	1	11/29/00
Cobalt	A	0.016	0.01		mg/L	1	11/29/00
Copper	A	ND	0.01		mg/L	1	11/29/00
Iron	A	75	0.05		mg/L	1	11/29/00
Lead	A	0.067	0.05		mg/L	1	11/29/00
Manganese	A	2.3	0.01		mg/L	1	11/29/00
Nickel	A	0.032	0.02		mg/L	1	11/29/00
Potassium	A	23	2		mg/L	1	11/29/00
Selenium	A	ND	0.1		mg/L	1	11/29/00
Sodium	A	86	2		mg/L	1	11/29/00
Thallium	A	ND	0.2		mg/L	1	11/29/00
Vanadium	A	ND	0.02		mg/L	1	11/29/00
Zinc	A	ND	0.03		mg/L	1	11/29/00

Samp Type: A - Analyte, S - Surrogate, I - Internal Standard
Qual: ND - Not Detected at the Reporting Limit
B - Detected in the associated Method Blank
E - Exceeds calibration range

DF - Dilution Factor
S - Spike recovery outside recovery limits
SD - Value diluted
R - RPD outside accepted recovery limits
E - Value above quantitation range
I - Matrix Interference

Preliminary

250 West 84th Drive, Merrillville, IN 46410 TEL.800.536.8379 TEL.219.769.8378 FAX 219.769.1664

[redacted] INTERNATIONAL

ANALYTICAL RESULTS

Date: *Thursday, November 30, 2000*

Client:	C.D.S., Inc.	***Client Project:***	ACS-Griffith
		Work Order:	ME0011268
Client Sample ID:	Influen:	***SIMALABS ID:***	ME0011268-01C
Sample Description:	Influen:		
Sample Matrix:	Aqueous		
Collection Date:	11/21/00		
Date Received:	11/21/00		

Analytes	Samp Type	Result	Reporting Limit	Qual	Units	DF	Date Analyzed
VOLATILE ORGANICS		Method: SW8260B		Prep Date:		Analyst: CLR	
Acetone	A	13000	500	E	µg/L	10	11/30/00
Acrolein	A	ND	1000		µg/L	10	11/30/00
Acrylonitrile	A	ND	1000		µg/L	10	11/30/00
Benzene	A	7900	50	E	µg/L	10	11/30/00
Bromodichloromethane	A	ND	50		µg/L	10	11/30/00
Bromoform	A	ND	50		µg/L	10	11/30/00
Bromomethane	A	ND	100		µg/L	10	11/30/00
2-Butanone	A	16000	100	E	µg/L	10	11/30/00
Carbon Disulfide	A	ND	100		µg/L	10	11/30/00
Carbon tetrachloride	A	ND	50		µg/L	10	11/30/00
Chlorobenzene	A	130	50		µg/L	10	11/30/00
Chloroethane	A	370	100		µg/L	10	11/30/00
Chloroform	A	440	50		µg/L	10	11/30/00
Chloromethane	A	ND	100		µg/L	10	11/30/00
Dibromochloromethane	A	ND	50		µg/L	10	11/30/00
1,2-Dichlorobenzene	A	ND	100		µg/L	10	11/30/00
1,3-Dichlorobenzene	A	ND	100		µg/L	10	11/30/00
1,4-Dichlorobenzene	A	ND	100		µg/L	10	11/30/00
1,1-Dichloroethane	A	3400	50	E	µg/L	10	11/30/00
1,2-Dichloroethane	A	1800	50		µg/L	10	11/30/00
1,1-Dichloroethene	A	56	50		µg/L	10	11/30/00
cis-1,2-Dichloroethene	A	5300	50	E	µg/L	10	11/30/00
trans-1,2-Dichloroethene	A	ND	50		µg/L	10	11/30/00
1,2-Dichloropropane	A	130	50		µg/L	10	11/30/00
cis-1,3-Dichloropropene	A	ND	50		µg/L	10	11/30/00
trans-1,3-Dichloropropene	A	ND	50		µg/L	10	11/30/00
Ethylbenzene	A	890	50		µg/L	10	11/30/00
2-Hexanone	A	570	50		µg/L	10	11/30/00
4-Methyl-2-Pentanone	A	11000	50	E	µg/L	10	11/30/00
Methyl-t-Butyl Ether	A	ND	100		µg/L	10	11/30/00
Methylene chloride	A	7200	100	E	µg/L	10	11/30/00
Styrene	A	ND	50		µg/L	10	11/30/00
1,1,1,2-Tetrachloroethane	A	ND	100		µg/L	10	11/30/00
1,1,2,2-Tetrachloroethane	A	ND	50		µg/L	10	11/30/00

Samp Type: A - Analyte, S - Surrogate, I - Internal Standard
Qual: B - Not Detected at the Reporting Limit
D - Detected at the associated Method Blank
E - Exceeds Maximum Contaminant Level

DF - Dilution Factor
S - Spike recovery outside recovery limits
SD - Spike diluted out
R - RPD outside accepted recovery limits
E - Values above quantitation range
I - Matrix Interference

250 West 84th Drive, Merrillville, IN 46410 TEL 800 536.8379 TEL 219.769.8378 FAX 219.769.1664

[redacted] INTERNATIONAL

ANALYTICAL RESULTS

Date: *Thursday, November 30, 2000*

Client:	C.D.S., Inc.	***Client Project:***	ACS-Griffith
		Work Order:	ME0011268
Client Sample ID:	Influent	***SIMALABS ID:***	ME0011268-01C
Sample Description:	Influent		
Sample Matrix:	Aqueous		
Collection Date:	11/21/00		
Date Received:	11/21/00		

Analyses	Samp Type	Result	Reporting Limit	Qual	Units	DF	Date Analyzed
Tetrachloroethene	A	*80*	50		µg/L	10	11/30/00
Toluene	A	*8800*	50	E	µg/L	10	11/30/00
1,1,1-Trichloroethane	A	*860*	50		µg/L	10	11/30/00
1,1,2-Trichloroethane	A	*68*	50		µg/L	10	11/30/00
Trichloroethene	A	*230*	50		µg/L	10	11/30/00
Vinyl Acetate	A	*ND*	100		µg/L	10	11/30/00
Vinyl chloride	A	*370*	100		µg/L	10	11/30/00
m,p-Xylene	A	*2900*	50		µg/L	10	11/30/00
o-Xylene	A	*1200*	50		µg/L	10	11/30/00
Surr: Toluene-d8	S	99	86-110		% REC	10	11/30/00
Surr: 4-Bromofluorobenzene	S	102	86-115		% REC	10	11/30/00
Surr: Dibromofluoromethane	S	99	86-118		% REC	10	11/30/00
Surr: 1,2-Dichloroethane-d4	S	98	80-120		% REC	10	11/30/00

Samp Type: A - Analyte, S - Surrogate, I - Internal Standard
Qual: - Not Detected at the Reporting Limit
- Detected in the associated Method Blank
- Exceeds Maximum Contaminant Level

DF - Dilution Factor
S - Spike recovery outside recovery limits
SD - Due dilution
R - RPD outside accepted recovery limits
E - Value above quantitation range
I - Matrix Interference

Preliminary

350 West 84th Drive, Merrillville, IN 46410 TEL.800.536.8379 TEL.219.769.8378 FAX 219.769.1664

APPENDIX D

NTH Consultants, Ltd.
Infrastructure Engineering
and Environmental Services

38955 Hills Tech Drive
Farmington Hills, MI 48331-3432
248.553.6300
248.324.5179 Fax

Mr. Dan Hanson, P.E.
Hanson Engineering, P.C.
9366 Lilley Road
Plymouth, MI 48170

January 5, 2001
Proj. No. 13-001340

RE: Initial Permeability Test Results
Soil-Bentonite Backfill Mixture

Dear Mr. Hanson:

We have completed the initial permeability tests on two companion samples of soil-bentonite mixture pursuant to our agreement. We understand that the soil-bentonite mixture is intended for use in a slurry wall to be constructed at the American Chemical Service NPL Site in Griffith, Indiana. We prepared the soil-bentonite mixture using soil and bentonite samples sent to us by your firm and proportioned the mixture to contain 4% bentonite as recommended in the design mix study. This study was presented in a report by J&L Testing Company, Inc., entitled "Final Report, Backfill Mix Design and Compatibility and Geomembrane Seam Evaluation, American Chemical Service, Inc. NPL Site, Griffith, Indiana Project" dated January 31, 1997. A copy of this report was previously provided to us by your firm.

Two specimens of soil-bentonite backfill were formed by adding the equivalent of 4 lbs. of oven-dry bentonite to 100 lbs. of dry soil. The moisture content of air-dry bentonite varies, depending on source and method of storage, but might typically be 10% to 12%. An equivalent mixture using air-dry bentonite might therefore be approximately 4.4 lbs. of air-dry bentonite to 100 lbs. of dry soil. Each specimen was then mixed to a moisture content of approximately 30%, creating a consistency equivalent to a high slump concrete, and was placed in the testing apparatus.

Permeability testing was performed in a fixed wall permeameter using the procedures of EPA Method 9100, Section 2.6. A confining load of 10 psi was placed on each specimen to match the average effective stress applied during the referenced mix design. The specimens were then permeated with clean, deaired tap water until stable, repeatable permeability results were obtained. The hydraulic conductivities determined from the tests on the two specimens were 6×10^{-8} and 7×10^{-8} cm/s

Permeation with site groundwater supplied to us by your firm is now underway. A graph of hydraulic conductivity versus time and versus pore volumes of groundwater permeant will be provided for each specimen in our final report when the testing is completed.

Respectfully submitted,

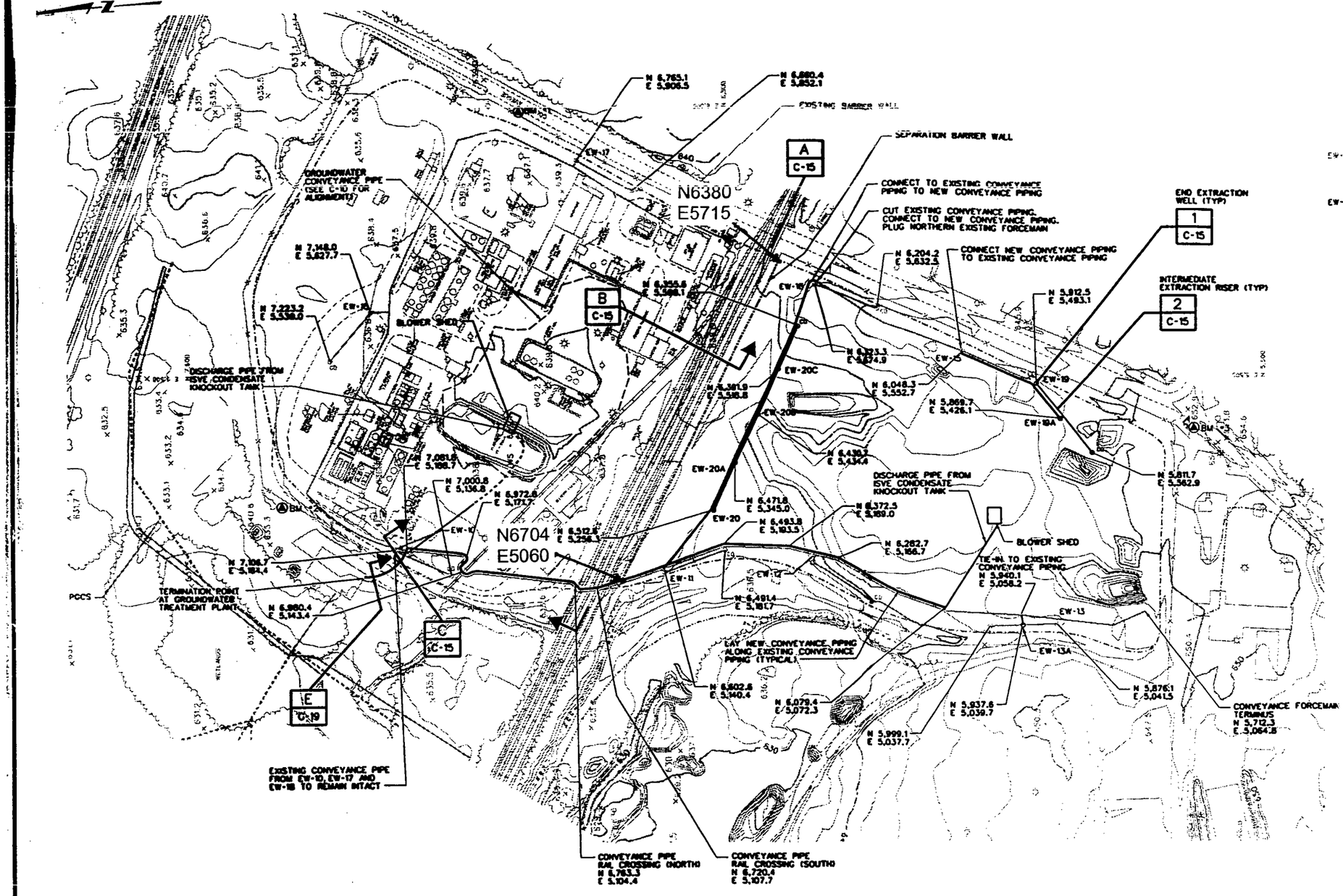
NTH Consultants, Ltd.

Wayne R. Bergstrom

Wayne R. Bergstrom, Ph.D., P.E.
Senior Project Consultant

C:\AllMyWord files\HansonLetter.doc

APPENDIX E



LEGEND

- CO — CLEANOUT AT END OF EXTRACTION TRENCH
- EW-20 — EXTRACTION WELL LOCATED AT END OF EXTRACTION TRENCH (SEE DETAIL 1, SHEET C-12)
- EW-20A — EXTRACTION WELL LOCATED ALONG EXTRACTION TRENCH (SEE DETAIL 2, SHEET C-12)
- EXISTING CONVEYANCE PIPING
- EXISTING EXTRACTION TRENCH (EW-11)
- PROPOSED CONVEYANCE PIPING
- PROPOSED EXTRACTION TRENCH (EW-19)

BENCHMARKS:

- BM #1 : REBAR N. 6871.36 E. 5996.85 EL. 638.95 ft-MSL
- BM #2 : REBAR N. 7312.73 E. 5266.80 EL. 634.98 ft-MSL
- BM #3 : REBAR N. 5619.76 E. 5408.62 EL. 653.54 ft-MSL

NOTE:

MEASUREMENTS FROM CONTROL POINTS BM # 1,2, AND 3 WERE RECORDED USING THE TOP OF A STATIONARY IRON PIPE

THOMAS A. BLAIR
REGISTERED
NO. 9600482
STATE OF INDIANA
PROFESSIONAL ENGINEER
expires 7/31/00
signature
3/20/99
date

REV	DATE	BY	DESCRIPTION

SCALE: 1" = 100'-0"

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED — DRAWN — CHECKED

SUBMITTED BY
TOM BLAIR (PROJECT MANAGER) — IN-19600482 LICENSE NO. — DATE
(COMPANY OFFICER) — LICENSE NO. — DATE

MONTGOMERY WATSON
Chicago, Illinois

ACS RD/RA GROUP
AMERICAN CHEMICAL SERVICE SUPERFUND SITE
GRIFFITH, INDIANA

100% REMEDIAL DESIGN

BARRIER WALL AND BARRIER WALL EXTRACTION SYSTEM PIPING LAYOUT

SHEET C-2

APPENDIX F

CONTRACT DEWATERING SERVICES INC.

WORK PLAN FOR THE CONSTRUCTION OF A SEPERATION BARRIER AT THE AMERICAN CHEMICAL SITE LOCATED AT 420 S. COLFAX, GRIFFITH INDIANA

MOBILIZATION

DELIVER TO THE SITE THE REQUIRED MATERIALS AND EQUIPMENT TO SUCESSFULLY CONSTRUCT THE BARIER WALL IN ACCORDANCE WITH OUR BARRIER WALL MIX DESIGN AND THE PROJECT SPECIFICATIONS.

THIS INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING:

- DELIVERY OF DEEP TRENCHER, EXCAVATOR AND RUBBER TIRED END LOADER FOR BARRIER WALL EXCAVATION
- DELIVERY AND SET UP OF A WATER SUPPLY LINE TO ASSIST IN BARRIER WALL SLURRY MIXING
- DELIVERY AND STAGING OF DRY BENTONITE IN 3000LB. SUPER SACKS FOR DRY MIXING IN THE BARRIER WALL TRENCH
- DELIVERY OF SUPPORT EQUIPMENT FOR SITE PREP, ASSISTANCE IN BARRIER WALL CONSTRUCTION AND FINAL CLEAN UP
- CALL FOR LOCATIONS ON ANY EXISTING SITE UTILITIES

SET UP WATER SUPPLY

- LAY OUT WATER LINE FROM WATER SUPPLY TO BARRIER WALL TRENCH
- FUSE TOGETHER HDPE WATER SUPPLY LINE
- INSTALL NECESSARY FITTINGS FOR WATER CONTROL

LAY OUT BARRIER WALL LOCATION

- SURVEY IN THE BARRIER WALL ALIGNMENT IN ACCORDANCE WITH THE CONTRACT DOCUMENTS

- CAREFULLY EXCAVATE AND LOCATE THE EXISTING BARRIER WALL AT THE TIE IN LOCATION AT EACH END OF THE NEW BARRIER WALL
- LOCATE AND REVEAL THE HDPE LINES NEAR THE EXISTAING WALL SO THEY WILL NOT BE DAMAGED BY THE TRENCHER AND THEY CAN BE CUT OUT OF THE WAY IN A CONTROLLED MANNER

PRE-EXCAVATION OF THE BARRIER WALL

- USING THE HYDRAULIC EXCAVATOR, EXCAVATE A 24-INCH DEEP TRENCH ON THE EXACT CENTERLINE OF THE BARRIER WALL.
- CALCULATE THE AMOUNT OF DRY BENTONITE REQUIRED TO ACHIEVE A 4% RATIO OF BENTONITE TO THE BACKFILL MIX PER FOOT OF BARRIER WALL CONSTRUCTED.
- PLACE THE REQUIRED DRY BENTONITE OUT OF THE 3000 LB SUPER SACKS INTO THE PRE-CUT 24 INCH TRENCH ALONG THE BARRIER WALL ALIGNMENT

INSTALLATION OF THE BARRIER WALL

- POSITION TRENCHER ON CENTERLINE OF THE PROPOSED BARRIER WALL AND STAY BACK A SAFE DISTANCE FROM THE EXISTING WALL AND SET THE BOOM IN THE GROUND TO THE REQUIRED DEPTH.
- ONCE THE PROPER DEEPTH IS REACHED, START ADDING WATER TO THE TRENCH AND START MIXING IN THE DRY BENTONITE. TRACK BACKWARDS AND TRENCH INTO THE EXISTING BARRIER WALL. CONTINUE MOVING TOWARDS THE EXISTING WALL UNTIL WE GET APPROVAL FROM THE ENGINEER TO CONFIRM THAT WE ARE AS CLOSE AS THEY REQUIRE.
- THEN WE WILL TRENCH BACK ALONG THE CENTERLINE,AND WE WILL BE ADDING WATER TO THE TRENCH TO ASSIST IN MIXING THE DRY BENTONITE WITH THE TRENCH BACKFILL MATERIAL
- THE WATER WILL BE REGULATED SO THE BACKFILL MIX WILL MAINTAIN A SLUMP BETWEEN 4 AND 7 INCHES. IF FOR SOME REASON THE SLUMP GETS LOWER THAN 7 INCHES WE WILL ADD MORE DRY BENTONITE TO THE BACKFILL MIX TO BRING THE SLUMP UP TO THE REQUIRED RANGE.

- AFTER EACH 100 FOOT RUN IS COMPLETE, WE WILL TAKE A SLUMP TEST TO VERIFY THAT THE PROPER SLUMP IS BEING MAINTAINED
- THE DRY BENTONITE WILL BE BLENDED INTO THE BARRIER WALL AND MIXED THOUROUGHLY TO THE BOTTOM OF THE TRENCH WITH THE CHAIN OF THE DEEP TRENCHER.
- WHILE THE BARRIER WALL IS BEING CONSTRUCTED, WE WILL BE CONSTANTLY VERIFYING THAT WE ARE ACHIEVING OUR TWO-FOOT KEY INTO THE LOWER KEY MATERIAL. THE KEY MATERIAL DEPTH WAS CONFIRMED WITH OUR PREVIOUS SOIL BORINGS
- ONCE WE HAVE GONE THROUGH THE FIRST 100 FEET AND THE MIX PER CENTAGES HAVE BEEN ESTABLISHED , WE WILL CONTINUE TO INSTALL THE BARRIER WALL UP TO THE EXISTING WALL
- ONCE AGAIN WE WILL TRENCH AS CLOSE TO THE EXISTING WALL AS DIRECTED BY THE ENGINEER.
- ONCE THE WALL IS COMPLETE, WE WILL FINISH GRADE OVER THE NEW WALL AND REMOVE ALL REQUIRED SPOIL MATERIALS TO AN APPROVED ON SITE DISPOSAL LOCATION
- WE WILL THEN DISASSEMBLE OUR SUPPORT EQUIPMENT, DO OUR FINAL CLEAN UP AND DECONTAMINATION. THEN WE WILL DE-MOBILIZE OUR EQUIPMENT OFF SITE.

CONTRACT
DEWATERING SERVICES
INC.

CQC PLAN FOR ACS SITE
GRIFFITH, IND.
FOR THE INSTALLATION OF THE SEPERATION BARRIER WALL

PERSONEL TO BE USED ON SITE:

• CONSTRUCTION MANAGER	RICHARD NEUMANN
• CONSTRUCTION SUPERVISOR	JOHN FLAK
• CONSTRUCTION FOREMAN	BARRY MEFFORD
• CQC REPRESENATIVE	SUSAN BERTRAND OF HANSON ENGINEERING
• TRENCHER OPERATOR	DENNIS KARRAR
• UTILITY OPERATOR	TOM DYKAS OR LOCAL 150 OPERATORS

OBSERVATION AND INSPECTION

OBSERVATION AND INSPECTION OF THE VERTICLE BARRIER WALL CONSTRUCTION WILL BE PERFORMED BY CONTRACT DEWATERING SERVICES INC. CQC REPRESENATIVE AND WILL INCLUDE THE FOLLOWING:

- VISUAL INSPECTION AND PHOTODOCUMENTATION OF THE INITIAL CLEARING AND GRUBBING, WORKBENCH CONSTRUCTION, AND VERTICLE BARRIER WALL CONSTRUCTION.
- VISUAL INSPECTIONS OF THE LATERIAL AND VERTICLE LIMITS OF THE BARRRIER WALL CONSTRUCTION.
- DOCUMENTATION OF THE TRENCH GRADES

- VISUAL CLASSIFICATION, DOCUMENTATION,AND SAMPLE COLLECTION FOR LABORATORY TESTING OF THE KEY MATERIAL
- OBTAINING SMAPLES FOR THE LABORATORY TESTING FROM THE SOIL-BENTONITE BACKFILL MIX

CONSTRUCTION TESTING

TRENCHING

- DEPTH OF THE TRENCH WILL BE TAKEN EVERY 10 FEET
- EACH DAYS PRODUCTION WILL BE VERIFIED BY MEASUREMENT

KEY IN MATERIAL

- THE EXACT DEEP OF THE KEY MATERIAL WILL BE DETERMINED IN ADVANCE OF THE SLURRY TRENCHING. PILOT HOLES WILL BE DRILLED AND SAMPLES WILL BE TAKEN TO VERIFY THE DEPTH OF THE KEY MATERIAL.
- MEASUREMENTS WILL BE TAKEN EVERY 10 FEET TO CONFIRM THE BARRIER WALL IS KEYING INTO THE LOWER CLAY KEY MATERIAL.

SLURRY

- THE DRY WEIGHT PERCENTAGE TO BE ADDED WILL BE CALCULATED FOR EACH 100-FOOT SECTION OF THE WALL. THE WEIGHT WILL BE DOCUMENTED.
- THE DRY BENTONITE WILL BE ADDED TO THE TRENCH AND DISPURSED EVENLY. THEN IT WILL BE MIXED WITH THE CHAIN OF THE TRENCHER UNTIL THE FINAL BACKFILL IS THOROUGHLY MIXED
- A SLUMP TEST WILL BE RAN FOR EACH 100 FEET OF TRENCH. THE SLUMP WILL BE MAINTAINED BETWEEN 4 AND 7 INCHES. THIS WILL ALSO BE RECORDED AND DOCUMENTED.
- DRY BENTONITE WILL BE ADDED TO THE BACKFILL IF THE SLUMP TEST IS BELOW 7 INCHES. IT WILL BE ADDED AND BLENDED UNTIL THE SLUMP IS BETWEEN 4 AND 7 INCHES.
- BACKFILL SAMPLES WILL BE TAKEN AND PERMEABILITY TESTS WILL BE RAN TO VERIFY THAT THE BACKFILL PERMEABILITY MEETS OR EXCEEDS THE CONTRACT DOCUMENTS.

CONSTRUCTION DOCUMENTATION

ALL THE DAILY QC REPORTING AND MEASUREMENTS WILL BE RECORDED IN THE FINAL CONSTRUCTION DOCUMENTATION.

35 MM PHOTOS WILL BE FURNISHED AND LABELED TO IDENTIFY ALL MAJOR ASPECTS OF THE WORK

A SET OF 22 BY 34 INCH AS BUILT DRAWINGS WILL BE FURNISHED SHOWING ALL FINAL ALIGNMENT AND DEDTAILS.

December 25,2000

APPENDIX G

DEC., 03,00

CONTRACT DEWATERING
HEALTH AND SAFETY PLAN
American Chemical Services
Table of Contents

CONTRACT DEWATERING SERVICES, INC.
SITE SPECIFIC HEALTH AND SAFETY PLAN
AMERICAN CHEMICAL SERVICES, INC.
GRIFFITH, INDIANA

1.0 INTRODUCTION

1.1 Site Details

Site Name: American Chemical Services, Inc. (ACS)

Client: Montgomery Watson

Work Location Address: 420 South Colfax Avenue, Griffith, IN

Project Manager: Richard Neumann

1.2 Site History

The site began operations in 1955, with reclamation of spent solvent waste. The Site accepted solvent mixtures containing alcohols, ketones, esters, chlorinates, aromatics, aliphatics, and glycols that contained various residues. Other processes that have operated at the site since 1955 include specialty chemical manufacturing in small batches, burning of still bottoms and non-reclaimable materials in incinerators (1965-1970), epoxidation and bromination operations, and storage and blending of waste streams for ACS's secondary fuel program.

The site included a drum storage area located in the northern third of the fenced ACS facility. The drum storage area was visible in a 1970 aerial photograph. However, an aerial photograph from 1973 indicates that the area was clear with no sign of drums on the ground surface. Approximately 400 drums containing sludge and semi-solids of unknown types were reportedly disposed of inside the plant (this area was named the "On-Site Containment Area").

From 1988 to 1992, a Remedial Investigation/Feasibility Study (RI/FS) was conducted at the Site. In 1992, a ROD was executed which described the remedial action to be implemented on the Site. During the RI, a test pit was excavated in the On-Site Containment Area, where drums were thought to be buried. Drums were found buried on

their sides, stacked 3-high and closely packed together. Construction activities conducted during installation of the Perimeter Groundwater Containment System (PGCS) and Barrier Wall Extraction System (BWES) verified the presence of buried drums stacked 3-high in the On-Site Containment Area. A geophysical investigation was subsequently conducted in February 1998 to determine the extent of the buried drums in the On-Site Containment Area. Based on past RI results, recent construction activities, and the 1998 geophysical investigation, two areas of buried drums were identified.

The Still Bottoms Pond Area, located in the central portion of the ACS facility, served as a repository for still bottoms waste from the solvent recycling process. The area contained a pond and "treatment lagoon" where still bottoms were disposed. The pond and lagoon have since been filled in with drum carcasses, rubble, soil, and other debris. During the RI, many borings were advanced in this area, and the concentrations of containments in the area indicate that it is a significant source area on Site.

The Wetlands to the west of the ACS facility were investigated in 1996 to determine the extent of impact from facility operations. Analytical samples collected during this investigation indicated that certain localized sediments in the wetlands area were contaminated with polychlorinated biphenyls (PCBs). These PCBs likely were transported from the facility via surface water runoff from the facility which drained into the wetlands area.

The Off-Site Area of the Site is located south of the ACS facility railroad tracks and encompasses the **Off-Site Containment Area** and the Kapica-Pazney building area. A large portion of the Off-Site Area is essentially a continuation of the Town of Griffith landfill. During the RI, installation of soil borings indicated contaminated areas in the central and southern portions of the Off-Site Area. The barrier wall construction, because it required excavation of several hundred feet at the perimeter of the Off-Site Area, verified the landfill nature of the area. During the Material Handling/LTTT Study, a portion of the central Off-Site Area was found to contain many deteriorated drum carcasses and parts. The area is also a significant source area on Site.

In February 1997, as part of the expedited interim remedial measures, a groundwater pump and treatment system was installed in the wetland area. The pumping system, referred to as the PGCS, provides containment for a groundwater plume in the northwest portion of the Site. In addition, a groundwater treatment system, including phase separation, UV/oxidation, precipitation, filtration, air stripping, and carbon absorption, was constructed to treat groundwater from the PGCS. The treatment system is housed in a 6000 existing square foot building. The treatment system is currently being upgraded to include an activated sludge plant, gravity phase separator, aerated equalization tank, secondary containment system, and building expansion. Construction for the upgrades may continue during performance of the work covered in this RFB.

In 1997, a continuous **barrier wall** was installed around the On-Site Containment Area, the ACS operating facility, the Off-Site Containment Area and the Kapica-Pazmey Area. The barrier wall encloses the known source areas at the Site. A groundwater extraction

system inside the barrier wall, comprised of eight 100-foot long extraction trenches, was installed to maintain a hydraulic capture zone within the barrier wall, and is referred to as the BWES. Groundwater from the BWES is also treated in the groundwater treatment system.

The PGCS has been operated since March of 1997, and the BWES was started-up in May 1997. Groundwater from these systems continues to be treated through the groundwater treatment system. Based on the performance data collected to date, these interim systems have successfully isolated the source areas of the Site thus preventing further off-site groundwater contamination from occurring and providing active treatment of groundwater from within the barrier wall (BWES) and in the northeast portion outside the barrier wall (PGCS).

1.3 Scope of Work

The purpose of this project is to construct a separation barrier wall to isolate subsurface containment in the "off-site" containment area. Types and levels of contamination expected to be encountered as part of the Work are described in Table I, attached. It should be noted that subsurface trash and debris may be encountered during the installation of the interior barrier walls. Provisions will be made to relocate the material into the Off-Site Containment Area.

As discussed above, a barrier wall has been previously installed around the site.

The objective of this separation barrier wall is to provide a continuous, vertical, hydraulic cutoff wall to isolate subsurface contamination on the southern side of the site (off-site containment area) and prevent migration of contaminants to the northern side of the site (on-site containment area). The interior barrier wall will tie into the existing perimeter barrier wall to effectively prevent migration to the joints. The interior barrier wall will maintain a hydraulic conductivity similar to the perimeter barrier wall which was 1 X 10^{-7} cm/sec. The design of the interior barrier wall will account for the fact that the wall will be exposed to known contaminants and concentrations for an extended period of time. Pump and treat operations inside the barrier wall may result in isolated or broad areas that are completely dewatered to the top of the clay confining stratum, resulting in a potential of 30 ft of hydraulic head (and thus gradient) on the separation barrier wall.

The second phase of the work at the ACS site includes the installation of two ground water extraction trenches that vary in length from 150 feet to 300 feet in length. These trenches will be used to lower the ground water inside the barrier wall. In addition to the extraction trenches, there will be five intermediate wells installed to various depths. These will also help to lower the ground water inside the barrier wall.

1.4 Health and Safety Plan (HASP)

The contractor and any subcontractors must provide trained personnel with a written, site specific, Health and Safety Plan in order to work on this site. Personnel training and HASP requirements are set forth in 29 CFR 1910.120. No contractor or agent, employee or assignee is to work at this site unless they comply in full with the health and safety requirements specified in 29 CFR 1910.120.

It is the policy of Contract Dewatering Services, Inc. to provide a safe workplace for its employees. To this end, the company, in concert with employees, will seek to comply with all applicable standards promulgated pursuant to any Federal or State Occupational Safety and Health Act.

Since the most important component of any safety policy or program is implementation, it is our intent to communicate the contents of this program to our employees. In turn, all employees are expected to comply with this document and will be disciplined if found to be in non-compliance. Any questions regarding this document should be addressed to Safety Officer, Richard Neumann.

It is the policy of this company to keep its employees informed of all safety rules contained in the Construction Safety Standards and the Occupational Health Standards.
Any employee may obtain a copy of the above referenced standards by contacting the company Safety Officer.

Please refer to Appendix A for our specific Job Hazard Analysis and familiarize yourself with the potential job hazards.

2.0 SITE PERSONNEL

2.1 HASP Responsibilities

The **Site Safety Manager** for activities to be conducted at this site is: Richard Neumann.

The Site Safety Manager has total responsibility for ensuring that the provisions of this Site HASP are adequate and implemented in the field.

Changing field conditions may require decisions to be made concerning adequate protection programs. Therefore, the personnel assigned as Site Safety Manager is experienced and meets the additional training requirements specified by OSHA in 29 CFR 1910.120, as necessary.

Qualifications: First aid and CPR trained, 40-hour trained and subsequent refreshers.

Barry Mefford may act as provisional Site Safety Manager and will have the ability for direct phone contact with Richard Neumann while on-site. **The on-site Health and Safety officer will be responsible for site monitoring.**

2.2 On-site Personnel

Richard Neumann, Project Manager
Barry Mefford, Assistant Project Manager

3.0 SITE ACTIVITIES

3.1 Task Information

TASK	DESCRIPTION	DATE
1. Separation Barrier Wall Construction	Oversee and conduct activities necessary to install a barrier wall providing a continuous, vertical, hydraulic cutoff isolating subsurface contamination on the south side of the site.	2000-01
2. Extraction Trench 19 Construction	Oversee and conduct activities necessary to install extraction trench 19 which is approximately 150 ft. long and 25 ft. deep. This includes the installation of two extraction wells, EW19 and EW19A.	2000-01
3. Extraction Trench 20 Construction	Oversee and conduct activities necessary to install extraction trench 20 which is approximately 350 ft. long and 20ft. deep. This includes the installation of four extraction wells, EW20, EW20A, EW20B, and EW20C.	2000-01
4. Extraction Well EW13A Installation	Oversee and conduct activities necessary to install extraction well EW13.	2000-01

3.2 Site Hazards

Physical: Explosive, Flammable; as identified in section **3.4** and Appendix C.
Operational as identified in section **3.5**

Chemical: Absorption, Direct Contact, Ingestion, Inhalation, Potential Carcinogens as identified in section **3.4** and Appendix C.

Radiation: Ultra-violet; Sunlight

Biological: Animals, Insects, Plants typical for the area and season.

3.3 Potential Contaminant Media

Air, Groundwater, Soil, Surface water

3.4 Contaminant Evaluation

TABLE 1

CONTAMINANT CONCENTRATIONS IN GROUNDWATER

Constituents	Units	Concentrated Range Detected	Expected Concentration
Water Quality			
pH	Std Unit	6 to 7	6.6
Dissolved oxygen	mg/l	0	0
Temperature	degree C	10 to 15	12
Specific Conductance	umHos/cm	900 to 5,000	1,500
Hardness total	mg/l-CaCO3	600 to 1,400	800
Residue, diss (TDS)	mg/l	800 to 6,500	700
Residue, susp (TSS)	mg/l	100 to 25,000	200
Alkalinity, total	mg/l-CaCO3	400 to 2,000	700
BOD	mg/l	10 to 37,000	200
COD	mg/l	100 TO 140,000	400
Carbon ((TOC)	mg/l	30 to 95,000	100
Oil and grease	mg/l	1 to 100,000	2
Anions			
Chloride	mg/l	30 to 1,000	300

Constituents	Units	Concentrated Range Detected	Expected Concentration
Nitrogen, TKN	mg/l as N	10 to 250	50
Phosphorus, total	mg/l as P	0.1 to 2	0.5
Sulfate	mg/l	100 to 270	260
Cations			
Antimony	mg/l	0.002 to 0.09	0.023
Arsenic	mg/l	0.01 to 0.05	0.019
Cadium	mg/l	0.01 to 1.0	0.14
Calcium	mg/l	180 to 270	200
Chromium, total	mg/l	0.01 to 2.3	0.02
Copper	mg/l	0.02 to 6	0.1
Iron	mg/l	15 to 1,500	100
Lead	mg/l	0.007 to 10	0.03
Magnesium	mg/l	35 to 70	50
Manganese	mg/l	NA	NA
Mercury	mg/l	0.0025	0.0007
Nickel	mg/l	0.02 to 2.0	0.2
Potassium	mg/l	6 to 30	10
Selenium	mg/l	0.002	0.002
Sodium	mg/l	NA	NA
Thallium	mg/l	0.0020	0.0019
Zinc	mg/l	0.06 to 160	5
Organics			
Acetone	ug/l	10 to 1,710,000	1,500
Benzene	ug/l	300 to 9,600,000	2,500
bis(2-Chloroethyl)ether	ug/l	10 to 800	20
bis(2-Ethylhexyl)phthalate	ug/l	10 to 320,000	50
2-Butanone	ug/l	10 to 970,000	2,000
Butyl benzyl phthalate	ug/l	1 to 3,100	600
Chloroethane	ug/l	1 to 3,100	600
Chloromethane	ug/l	2 to 2,000	30
4-Chloro-3-methylphenol	ug/l	10	10
1,2-Dichlorobenzene	ug/l	1 to 570,000	200
1,1-Dichloroethane	ug/l	10 to 25,000	500
1,2-Dichloroethane	ug/l	10 to 66,000	78.5
1,1-Dichloroethene	ug/l	1 to 80.0	2.5
1,2-Dichloroethene-cis	ug/l	10 to 75,000	1.317
1,2-Dichloroethene-trans	ug/l	1 to 20.0	27.0
1,2-Dichloropropane	ug/l	1 to 300	4.7
Diethyl phthalate	ug/l	10 to 25,000	40
2,4-Dimethylphenol	ug/l	10 to 3,800	50
Dimethyl phthalate	ug/l	10 to 25,000	20
Di-n-butyl phthalate	ug/l	10 to 65,000	20
Ethylbenzene	ug/l	3 to 6,200,000	300
Isophorone	ug/l	10 to 77, 000	50
Methylene Chloride	ug/l	50 to 940,000	300
4-Methyl-2-pentanone	ug/l	10 to 2,900,000	500

Constituents	Units	Concentrated Range Detected	Expected Concentration
4-Methylphenol	ug/l	10 to 560	20
Naphthalene	ug/l	2 to 2,400,000	50
Phenol	ug/l	10 to 17,000	200
Tetrachloroethene	ug/l	10 to 35,200,000	500
Tetrahydrofuran	ug/l	10 to 4,000	20
Toluene	ug/l	300 to 31,400,000	1,000
1,1,1-Trichloroethane	ug/l	10 to 15,000,000	1,000
Trichloroethene	ug/l	10 to 7,600,000	1,000
Trichlorofluoromethane	ug/l	1 to 130,000	10
Vinyl chloride	ug/l	1 to 26,000	100
Xylenes, total	ug/l	5 to 35,000,000	1,000

NA = Not available

Based on the above listed "Expected Levels", Benzene has the greatest potential to exceed its Time Weighted Average (TWA) of 100ppb.

3.4.2. Material Safety Data Sheets (MSDS) / Chemical Data Sheets

Material Safety Data Sheets (MSDS) and or Chemical Data Sheets from acceptable sources will be provided in Appendix B of this HASP for all chemicals, reagents, solutions of identified materials that in the normal process of completing the tasks for this project could provide the potential for exposure. All subcontractors and any other parties working on this site will be informed of the presence of these substances and the location of the appropriate MSDS or data sheets. All subcontractors will be required to provide MSDS or Chemical Data sheets for any and all hazardous materials used or stored on site during the performance of their contracts. That information will also be made available for inclusion in Appendix C of this HASP.

3.5 Potential Operational Hazards

Potential hazards are present at the job site and may vary from day to day and task to task. All site personnel will be familiar with these potential hazards and take the appropriate precautions and any steps necessary to mitigate any potential risk from these hazards at all times. If a hazard arises that has not been identified in this HASP or discussed during the on–site safety briefings, the Site Safety Manager should be contacted immediately.

Potential Hazards include: Noise; Heat or Cold Stress; Slips, Trips and Falls; Working Over/In Water; Traffic; Heavy Equipment; Overhead Cranes/Drilling; Utilities/Electrical; High Pressure/Steam.

4.0 ACCIDENT PREVENTION PLAN

4.1 General Guidelines

1. It is the policy of Contract Dewatering Services, Inc. to furnish each employee employment which is free from recognized hazards that are causing or are likely to cause death or serious physical harm to such employee.

2. Contract Dewatering Services, Inc. designated Richard Neumann as corporate Safety Officer. This person is responsible for the implementation of the Company's safety program. If any employee needs to know who the Company Safety Officer is, they can find out by asking any foreman.

3. When practical, employees of Contract Dewatering Services, Inc. will participate in safety seminars sponsored by Associated Underground Contractors, Inc. and/or other organizations.

4. The Safety Officer shall designate a qualified employee on each crew or project who will have the following responsibilities:

    a. Instruct each employee regarding operating procedures, hazards and safeguards of tools and equipment when necessary to perform the job.

    b. Inspect the construction site, tools and equipment to assure unsafe conditions that may create a hazard are eliminated.

    c. Instruct each employee in the recognition and avoidance of hazards.

    d. Instruct each employee, where known harmful plants, reptiles, animals or insects are present, as to the potential hazards, how to avoid injury, and applicable first aid procedures to be used in the event of injury.

    e. Instruct each employee required to handle or use known poisons, toxic materials, caustics and other harmful substances regarding the potential hazards, how to avoid injury, and applicable first aid procedures to be used in the event of injury.

    f. Instruct each employee required to enter a confined space regarding the Hazards involved, the necessary precautions to be taken, the use of personal protective equipment, and the procedures to be followed if an emergency occurs.

    g. Instruct all employees in the steps to be taken in case of an injury or accident.

5. Contract Dewatering Services, Inc. shall not knowingly permit an employee to work while under the influence of intoxicating beverages or substances which would impair the employee's ability to perform a task in a safe manner. Additionally, no employee shall possess/use intoxicating beverages or controlling substances at any Contract Dewatering Services, Inc. site or facility. Any employee violating this policy is subject to immediate dismissal.

6. The job foreman will inspect all machines, tools and equipment on a regular basis to make certain that no defect is present that will affect the safety of employees.

7. All employee complaints or concerns regarding safety shall be immediately brought to the attention of the Safety Officer.

8. Periodic meetings will be held to inform all employees of the company safety program.

9. This safety program shall be made available to all employees.

10. A copy of the AUC *Trench Safety Handbook* shall be made available to all employees who are involved in working in open excavations.

11. Employees will adhere to the following Safety Rules:

4.2 Miscellaneous Rules

1. Do not use tools or equipment that you have not been trained or authorized to use. This rule also applies to power activated tools.

2. Gasoline must be stored and transported in approved cans only. Engines must be shut-off when refueling and no smoking anywhere near flammable liquids.

3. Immediately report all injuries, whether to yourself or a co-worker, to your foreman.

4.3 Trenching Rules

1. All employees outside of a cabbed vehicle or covered piece of equipment must wear a hard hat. Never use metal hard hats.

2. All employees working in excavations or trenches must always stay within the protective system (trench shield, shoring, sloping).

3. Never climb on shoring, trench shields, or sloped walls or ride o any lift, hook, chain, cable, sling, or other equipment parts.

4. Ladders in a trench must extend at least 3 feet above the top of the

trench. All employees working in a trench must be within 25 feet of a ladder or ramp.

5. For further excavation information, refer to the AUC *Trench Safety Handbook.*

6. All trenches over 5' deep must be cut to the angle of repose, sheeted or shored.

4.4 Confined Space Rules

1. Do not enter an area classified as a confined space unless you are properly trained and authorized by the company's qualified person. If you don't understand the definition of a confined space, ask your foreman.

2. Atmospheric tests shall be made before any employee enters a confined space or goes underground and the results recorded. If a dangerous atmosphere is encountered, the space shall be ventilated and air quality must be acceptable before entry is allowed. Any positive reading of toxic or explosive gas and any excessive or low levels of oxygen shall be reported to your foreman. No employee shall enter the confined space under these conditions until such time that the readings are at an acceptable level.

4.5 Personal Protective Equipment Rules

1. All employees outside of a cabbed vehicle or covered piece of equipment must wear a hard hat. Never use metal hard hats.

2. Wear proper eye protection (goggles, safety glasses, etc.) when necessary.

3. Hearing protection shall be used where loud noise is present.

4. Wear safety vests when directing traffic.

5. Proper clothing will be worn, including hard toe work boots when required, shirts and pants.

6. In the event that any work task needs to be performed above the PPE levels described in the CDS Health and Safety plan, the following rules will apply: A written plan will be furnished to all site personnel explaining the level of PPE required. This plan will describe the PPE and the daily use and maintenance of the PPE. Under no circumstances will work be carried out unless a written plan for the required PPE level is in place and reviewed by all employees.

4.6 Heavy Equipment Rules

1. Every employee, not just the equipment operator, must be fully aware of all safety aspects of heavy construction equipment.

2. Be constantly alert when working around heavy equipment. The operator cannot always see other personnel around his equipment. Stay out from under suspended loads, away from moving equipment, and counterweights.

3. Only designated individuals shall be permitted to operate or service heavy equipment.

4. Perform frequent and periodic inspection as required.

5. The equipment operator must wear the seat belt when required.

6. No employee is permitted to ride on any part of the equipment.

7. It is the responsibility of all employees to make certain that back-up alarms on obstructed rear view heavy equipment be in operable condition.

8. Maintain a 10' minimum clearance from energized lines, use a spotter in difficult areas.

All employees who engage in any activities at this site are obligated to read and comply with the requirements in this HASP. A statement that these individuals have read and will comply with these requirements must be signed before entering the site (Appendix A). A copy of this plan and the compliance statement will be maintained at an on-site field location during all field activities.

In accordance with this SSHASP, PPE guidelines, and 29 CFR 1910.132, prior to personnel beginning work at the site, the Site Manager will have evaluated conditions and verified that the personal protective equipment selection outlined within this HASP is appropriate for the hazards known or expected to EXIST.

5.0 PROJECT DESCRIPTION/TASK EVALUATION

The ACS project involves four discrete tasks as identified in section **3.1**. A risk assessment of those tasks has identified the level of risk associated with each task and the corresponding level of protection required.

5.1 Task 1- Separation Barrier Wall Construction

Contract Dewatering will provide oversight and construction of the separation barrier wall.

5.1.1 Personal Protective Equipment (PPE): Level D PPE includes safety glasses, work gloves, logbook and camera.

5.1.2 Potential Hazards, Risk Level and Justification

Hazard	Risk Level	Justification
Chemical	Low	Contamination is present in site soils and groundwater, and is potentially present in ambient air.
Physical	Low	There are slip, trip and fall hazards. Depending on the weather, heat or cold may be an issue.
Biological	Low	Exposure to plants and animals is not expected. Proper PPE should be worn at all times.
Radiological	Low	No ionizing radiation hazards are known to exist in the area. Non-ionizing radiation hazards will be present in the form of sunlight. Site personnel should be aware of the hazards and take proper precautions for overexposure. Precautions include: sunscreen, working in the shade when possible, taking breaks in the shade, and wearing a hat for head and face protection.

5.1.3 Levels of Protection/Justification

Level D PPE will be worn for all tasks. Additional PPE (**Modified Level D**) may be worn to help to avoid contact with potential biological hazards, to prevent exposure to the sun and other weather-related hazards, and to keep workers clean.

5.1.4 Safety Procedures Required and/or Field OPS Utilized

Follow applicable safety procedures outlined in this HASP and follow the buddy system. SOPs are contained in the Contract Dewatering manual and is available from the site manager

5.2 Task 2- Oversee and Construct Extraction Trench 19

Contract Dewatering will provide oversight of the installation of Extraction Trench 19 and two extraction wells EW19 and EW19A.

5.2.1 Personal Protective Equipment (PPE): Level D PPE includes safety boots, safety glasses, work gloves, logbook, and camera. Disposable latex gloves will be worn for all sampling activities.

5.2.2 Potential Hazards, Risk Level and Justification

Hazard	Risk Level	Justification
Chemical	Low	Contamination is present in levels above residential drinking water standards. Inhalation exposure is not expected during this task.
Physical	Moderate	There are slip, trip and fall hazards. Contract Dewatering should be careful around the heavy machinery used for trenching. Depending on the weather, heat or cold may be an issue.
Biological	Low	Exposure to plants and animals is not expected. Level D PPE should be worn at all times.
Radiological	Low	No ionizing radiation hazards are known to exist in the area. Non-ionizing radiation hazards will be present in the form of sunlight. Site personnel should be aware of the hazards and take proper precautions for overexposure. Precautions include: sunscreen, working in the shade when possible, taking breaks in the shade, and wearing a hat for head and face protection.

5.2.3 Levels of Protection/Justification

Level D PPE will be worn for all tasks. Additional PPE **(Modified Level D)** may be worn to help to avoid contact with potential chemical or biological hazards, to prevent exposure to the sun and other weather-related hazards, and to keep workers clean.

5.2.4 Safety Procedures Required and/or Field OPS Utilized

Follow applicable safety procedures outlined in this HASP and follow the buddy system. SOPs are contained in the Contact Dewatering operations manual kept on-site.

5.3 Task 3- Oversight and Construction of Extraction Trench 20

Contact Dewatering will provide oversight and construction of Extraction Trench 20 and install extraction wells EW20, EW20A,EW20B ansEW20D

5.3.1 Personal Protective Equipment (PPE)

Level D PPE includes safety boots, safety glasses, work gloves, logbook, and camera. Disposable latex gloves will be worn for all sampling activities.

5.3.2 Potential Hazards, Risk Level and Justification

Hazard	Risk Level	Justification
Chemical	Low	Contamination is present in site soils and groundwater, and may be present in ambient air. Following specified action levels will minimize potential exposure. Contract Dewatering personnel will stay out of any hot zones, in an area where air concentrations are below the action level.
Physical	Moderate	There are slip, trip and fall hazards. Contract Dewatering should be careful around the geoprobe and excavation equipment, which may have pinch points and overhead hazard potential. Depending on the weather, heat or cold may be an issue.
Biological	Low	Exposure to plants and animals is not expected. Level D PPE should be worn at all times.
Radiological	Low	No ionizing radiation hazards are known to exist in the area. Non-ionizing radiation hazards will be present in the form of sunlight. Site personnel should be aware of the

		hazards and take proper precautions for overexposure. Precautions include: sunscreen, working in the shade when possible, taking breaks in the shade, and wearing a hat for head and face protection.

5.3.3 Levels of Protection/Justification

Level D PPE will be worn for all tasks. Additional PPE (**Modified Level D**) may be worn to help to avoid contact with potential biological hazards, to prevent exposure to the sun and other weather-related hazards, and to keep workers clean. Disposable latex gloves will be worn by Contract Dewatering personnel when direct contact to groundwater is expected to occur. Subcontractors to perform work under their own HASP.

5.3.4 Safety Procedures Required and/or Field OPS Utilized

Follow applicable safety procedures outlined in this HASP and follow the buddy system. SOPs are contained in the Otwell Mawby operations manual kept on-site.

5.4 Task 4- Extraction Well EW13A Installation

Contract Dewatering personnel will oversee and install the extraction well EW13A.

5.4.1 Personal Protective Equipment (PPE): Level D PPE includes safety boots, safety glasses, work gloves, logbook, and camera. Disposable latex gloves will be worn when direct contact with ground water is expected to occur.

5.4.2 Potential Hazards, Risk Level and Justification

Hazard	Risk Level	Justification
Chemical	Low	Contamination is present in levels above residential drinking water levels but not expected to exceed direct contact levels. Contract Dewatering personnel will be donning Level D PPE and wearing disposable latex gloves during direct contact activities. Inhalation exposure is not expected during this task.
Physical	Low	There are slip, trip and fall hazards. Depending on the weather, heat or cold may be an issue.
Biological	Low	Exposure to plants and animals is not expected. Level D PPE should be worn at all times.
Radiological	Low	No ionizing radiation hazards are known to exist in the area. Non-

ionizing radiation hazards will be present in the form of sunlight. Site personnel should be aware of the hazards and take proper precautions for overexposure. Precautions include: sunscreen, working in the shade when possible, taking breaks in the shade, and wearing a hat for head and face protection.

5.4.3 Levels of Protection/Justification

Level D PPE. Additional PPE may be worn to help to avoid contact with potential biological hazards, to prevent exposure to the sun and other weather-related hazards, and to keep workers clean. Disposable latex gloves will be worn by Contract Dewatering personnel during times when direct contact to the groundwater is expected to occur. Subcontractors to perform work under their own HASP.

5.4.4 Safety Procedures Required and/or Field OPS Utilized

Follow applicable safety procedures outlined in this HASP and follow the buddy system. SOPs are contained in the Contract Dewatering operations manual kept on-site.

Contract Dewatering will provide oversight of any air monitoring activities in and around structures where the soil or groundwater levels are found to be above violations to indoor or ambient air Risk Based Screening Levels (RBSLs).

6.0 SITE CONTROL

6.1 Engineering Controls

For all tasks, PID monitoring should be conducted on a regular basis. CDS Health and Safety officer will be taking air monitoring readings every 30 minutes and recording the data on daily reports.

CDS will utilize a PI-HW series H-NU meter. This meter will have a range of 0.1 to 2,000 ppm and will utilize a 10.2 EV lamp. If readings of 1 ppm are detected, we will use a Drager tube to determine if the contaminate is benzene or from another source. The source and the TLV of the source will be evaluated before we determine the necessity for PPE upgrade.

The exclusion zone around the intrusion area will be identified with caution tape and a sign will be posted at the entrance of the exclusion zone stating that no unauthorized entry is allowed.

6.2 Administrative Controls

Personnel will attend regular safety meetings prior to initiation of site work. Contract Dewatering personnel will check in with the site manager periodically and at the end of the

day to maintain communications and will stay upwind and away from heavy equipment when possible.

6.2.1 Emergency Response Information

1. As part of its safety program it is the policy of **Contract Dewatering** to make certain that all employees have been instructed as to proper procedures in case of an injury or accident.

2 **Contract Dewatering** designates the 911 system as its first response in the event of a medical emergency and/or rescue operation.

3. A list of emergency phone numbers will be posted at the jobsite when practical. If no suitable or convenient location exists, the list will be kept by the project foreman.

4. All injuries and/or accidents shall be reported to the job foreman immediately.

5. All accidents and/or injuries shall be reported to the Safety Officer as soon as is practical.

6 **Contract Dewatering** will provide a person at each job site who is trained in CPR and First Aid procedures as required by any applicable Safety & Health Standards.

7. Never move an injured person unless absolutely necessary. Further injury may result. Keep the injured comfortable and utilize available first aid equipment until an ambulance arrives.

6.3 Personnel Protective Equipment (PPE)

6.3.1 PERSONAL PROTECTIVE EQUIPMENT POLICY

It is the policy of **Contract Dewatering** that all employees comply with the Michigan Occupational Safety and Health Act standards in regards to the use of personal protective equipment. Violation of this policy will be subject to discipline as outlined in this section.

1. This company shall provide all personal protective equipment as required in Part 6 of the MIOSHA standards.

2. All employees outside of a cabbed vehicle or a covered piece of equipment must wear a hard hat. There will be no exceptions to this rule.

3. All employees must wear required hand protection, gloves, etc., when an employee is exposed to hazards such as radiation, alkalies, acids, adhesives and temperature

extremes other than those caused by weather conditions. Appropriate hand protection other than ordinary work gloves will be supplied by the company.

4. Any employee directing vehicular traffic must wear a fluorescent orange vest.

5. All employees must wear proper foot protection if conditions on the job are likely to cause foot injury. Tennis shoes or similar footwear is strictly forbidden.

6. The use of face and eye protection will vary according to the task performed. All employees must consult with the qualified employee to determine the proper method of protection and this protective gear must be worn.

7. Any personal protective equipment that is found to be defective shall be immediately reported to the safety officer or qualified person.

8. Acknowledgment of receipt of personal protective equipment will be kept on file at the company office.

9. A company disciplinary policy is in effect regarding personal protective equipment and is available to all employees upon request.

During all tasks:

PID reading	Action Level
0-1	Level D PPE continue to monitor with PID
>1	Contract Dewatering personnel may leave area temporarily to assess the situation add additional PPE as required. Level C including Face mask or respirator may ultimately be necessary for re-entry.

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6.4 Description of Levels of Protection - During All Tasks			
Protection Equipment	**Level D**	**Level D Modified**	**Level C**
Head: Hard Hat if Necessary	X	X	X
Full-face or half-face air-purifying respirator (OSHA/NIOSH approved)			X
Eye and Face: Safety glasses or goggles if necessary	X	X	
Hearing: Ear plugs or muffs if necessary	X	X	X

Appropriate Work Uniform	X	X	
Whole Body: Tyvek if necessary		X	X
Hand: leather work gloves if necessary	X	X	
Gloves: Inner if necessary to keep clean	X		
Gloves: Inner surgical		X	
Gloves: Outer Chemical Resistant			X
Foot: Safety Boots	X	X	
Boots: Outer Chemical Resistant, steel toe and shank			X
Boots: Water resistant overboots if necessary		X	
2-way communication			X
Other: sunscreen if necessary	X		

6.5 Heat Stress Disorders - During All Tasks

Heat stress disorders are common among workers exposed to extreme heat and humidity. Provisions will be made for frequent work breaks and fluid replacement according to the following schedule:

Suggested Frequency of Work Breaks and Fluid Replacement For Fit and Acclimatized Workers

Adjusted Air Temperature*	Modified D Normal Work Ensemble **
90° F or above	After Each 45 Minutes Work
87.5° to 90° F	After Each 60 Minutes Work
82.5° to 87.5° F	After Each 90 Minutes Work
77.5° F to 82.5° F	After Each 120 Minutes Work
Below 77.5° F	After Each 120 Minutes Work

*Calculate the adjusted air temperature by using the equation for dry bulb
use: Adjusted Air Temp F = Thermometer Reading F (13 X Estimated % Sunshine), % Sunshine is estimated by judging what proportion of time the sun is not covered by clouds thick enough to produce a shadow.
**Modified Normal Work Ensemble consists of a Tyvek Suit over lightweight cotton clothing.

Heat stress disorders can be fatal if not attended to properly. All workers on site will be instructed in the signs and symptoms of, and First Aid for Heat Cramps, Heat Exhaustion and Heat Stroke.

6.6 Exposure to Cold - During All Tasks

Cold exposure and hypothermia are prevented or mitigated by provision of heated compartments on heavy equipment, and heated facilities for worker breaks.

TLV's Work/ Warm Up Suggested Schedule for Four Hour Shifts

Air Temperature – Sunny Sky	No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
Degree F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-15 to –19 deg.	(Norm. Break)	1	(Norm. Break)	1	75 min	2	55 min.	3	40 min.	5
-20 to –24 deg.	(Norm. Break)	1	75 min	2	55 min.	3	40 min.	5	30 min	5
-25 to -29 deg.	75 min	2	55 min.	3	40 min.	5	30 min	5	Non-emergency work should cease	
-30 to –34 deg.	55 min.	3	40 min.	5	30 min	5	Non-emergency work should cease			
-35 to –39 deg.	40 min.	5	30 min	5	Non-emergency work should cease					
-40 to –44 deg.	30 min	5	Non-emergency work should cease							
-45 deg & below	Non-emergency work should cease									

TLV = Threshold Limit Value

6.7 Confined Space Protocols

An entry into a confined space is not anticipated in this scope of work. Construction regulations define a trench of over 4 feet in depth as a confined space unless it contains a ladder and the side walls are set at an angle of 45 degrees or more (sandy soil) in order to prevent engulfment.

6.7.1 Confined Space Program

1. <u>CONFINED SPACE DEFINITION</u>

   A. Confined space or enclosed space means any space having a limited means of entry and exit, which may be subject to the accumulation of toxic of flammable contaminants or may have an oxygen deficient atmosphere. Confined or enclosed spaces include, but are not limited to, storage tanks, underground utility vaults, tunnels, pipelines, manholes, gatewells, catch basins and open top spaces more than 4 feet in depth such as pits, tubs, vaults, and vessels.

2. **TRAINING EMPLOYEES**

A. All employees required to enter into confined or enclosed spaces shall be instructed as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of protective and emergency equipment required. The company shall comply with any specific regulations that apply to work in confined spaces.

3. **TESTING AIR QUALITY**

A. The atmosphere of the confined or enclosed space to be entered will be tested for oxygen deficiency and gaseous condition which are possible in the confined or enclosed space. The results of the testing will be recorded and meet the guidelines set up by the Michigan Department of Public Health, Division of Occupational Health. In testing the air quality in a confined space the minimally acceptable respirable atmosphere will be as follows; oxygen, 99.5%; combustible gas, 5% of the lower explosive limit (L. E. L.) for each gas; chemicals, the airborne concentration of each chemical present must be compared with the Michigan Occupational health limits -- Maximum Allowable Concentration.

B. The testing of a confined space will be done by a positive type reading instrument to give the levels at the time before entry and this will be recorded before entry into the space. The testing will be done by a qualified person who has been trained how to operate the instrument, calibrate the instrument, and the testing procedures.

4. **VENTILATION**

A. When necessary to assure air quality, proper ventilation will be put into effect to allow entry into the confined space or enclosure, to allow for safe entry. If natural ventilation is not adequate, ventilation equipment will be used to maintain respirable atmosphere in the confined space during the time employees are inside.

5. **SAFETY AND EMERGENCY EQUIPMENT**

A. Air monitoring devices will be on site and will be calibrated by trained personnel, these devices will be able to monitor oxygen deficient atmosphere, toxic, or combustible gases.

B. In the event that local emergency units are not readily available, safety and emergency equipment will be on site and ready to use at the confined space or enclosure which is occupied by personnel and will be ready and easily accessible to personnel for rescue. Examples of rescue equipment are rescue rope or lifelines, safety harnesses, first aid kits, and any other equipment

that would be needed to provide for safe rescue.

6. **GENERAL SAFETY CONCERNS**

A. If ventilating a confined or enclosed space opening interferes with vehicular traffic, appropriate warning signs and protective barriers shall be promptly set up before the covers of manholes, hand holes, or vaults are removed. The wording of a warning sign would depend upon the nature and the location of the hazards involved. Before an employee enters a street opening such as a manhole, it shall be protected with a barrier, temporary cover, or other suitable guard.

B. If circumstances dictate that the company employees perform rescue procedures, means shall be provided for quick removal of employees in case of emergency. When a safety harness and lifeline are used, they should be properly attached to the employee so that his/her body cannot be jammed in the exit opening.

C. A standby employee with a pre-plan rescue procedure shall be stationed outside the entrance to the confined or enclosed space to observe or communicate with the employee(s) at all times. The standby employee shall be trained and equipped to initiate rescue operation. It should be realized that a single person can seldom raise an unconscious body without a mechanical device. This rule is interpreted to mean that without such a device, additional personnel must be within easy summoning distance. It is also interpreted to require approved self-contained breathing apparatus or escape type air-line respirators for the additional personnel who may have to enter the confined or enclosed space to perform a rescue.

D. The above written procedures are the guidelines to be **Contract Dewatering** and its employees in a confined or enclosed space, and all other rules that are not covered in this above procedure shall be governed by the Michigan Department of Public Health, Division of Occupational Health confined or enclosed space entry procedures.

E. This confined space entry portion of the CDS Health and Safety Plan is only to familiarize employees of the hazards associated with confined space entry. If confined space entry is required at the American Chemical Site, we will prepare and submit for approval a specific confined space entry program.

7.0 SITE AIR MONITORING PROGRAM

During all tasks, organic and inorganic gases and vapors, and particulates will be monitored. The following **Action Levels** indicate the appropriate response. These Action Levels, if not defined by regulation, are some percent (usually 50%) of the applicable PEL/REL/TLV. That number must also be adjusted for instrument response factors.

7.1 Organic Gases and Vapors

During **ALL** tasks.

ACTION LEVEL	ACTION
0-1 unit above background on FID or PID	**Continue monitoring in worker breathing zone.**
>1 unit above background on FID or PID	**Evacuate area, re-evaluate the proper level of PPE required. Change PPE to the proper level and continue work.**

7.2 Inorganic Gases, Vapors and Particulates

During **ALL** tasks.

ACTION LEVEL	ACTION
No visible dust	**Continue work**
Visible Dust	**Initiate control measures or stop work until dust is below visible levels.**

8.0 CONTINGENCIES

8.1 Emergency Contacts and Phone Numbers

AGENCY	CONTACT	PHONE NUMBER
Local Medical Emergency Facility (LMF)	Emergency Room	(219) 865-2141
Medical Emergency Contact	John Flak	(630) 406-8343 Business

		(630) 251-7970 Cellular
Health and Safety	Barry Mefford	(616) 540-8481 Cellular
Fire Department	Fire Department	911
Police Department	Police Department	911
Site Phone	Contract Dewatering Mobile Phone	(616) 540-8481 B. Mefford (630) 251-7970 J. Flak
Nearest Phone	Contract Dewatering Mobile Phone	(616) 540-8481 B. Mefford (630) 251-7970 J. Flak

8.2 Local Medical Emergency Facility

St. Margaret Mercy HealthCare
South Campus
24 Joliet Street
Dyer, IN 46311

Phone No. (219) 865-2141

OR Phone No. 911

Name of Contact: EMERGENCY available 24 hours
Type of Service: Physical Trauma and Chemical Exposure
Travel time from site: 21 minutes
Distance to hospital: 7.2 miles
No. of 24 hour Ambulance Service: 911
Directions:
North on Colfax to Main Street West to Route 41 South to Route 30 West. St. Margaret Mercy HealthCare is three miles or so on left side of the road

8.3 Response Plans

8.3.1 Medical - General

Provide First Aid as trained, assess and determine need for further medical assistance. Transport or arrange for transport after appropriate decontamination. First Aid Kit. No eyewash or shower required. No Health Facility on site. No special first aid procedures for cyanide because no cyanide on-site.

8.3.2 Spill/Release

In the event of a spill or release, ensure safety, assess situation and perform containment and control measures as appropriate.

a) **Clean up per MSDS if small or; Sound Alarm, call for assistance. Notify Emergency Coordinator.**
b) **Evacuate to pre-determined safe place.**
c) **Account for personnel.**
d) **Determine if Team can respond safely.**
e) **Mobilize per Site Spill Response Plan**

83.3 Fire/Explosion

In the event of a fire or explosion, ensure personal safety, assess situation and perform containment and control measures as appropriate.

FIRE EXTINGUISHER: ABC located in Vehicle or on Drilling Rig

a) **Sound Alarm and call for assistance. Notify Emergency Coordinator.**
b) **Evacuate to predetermined safe place.**
c) **Account for personnel.**
d) **Use fire extinguisher. ONLY IF SAFE AND TRAINED.**
e) **Standby to inform Emergency responders of materials and conditions..**

8.3.4 Security Problems

Plan to respond to security problems is to call **911** on mobile phone.

8.3.5 Accident and Incident Reporting

All accidents and injuries must be reported to a foreman or the Site Safety Manager immediately. The supervisor or contractor representative will complete the reporting process as described in the Federal Safety Program.

All environmental, health and safety incidents and data will be recorded in the field record books. Any OSHA and/or required Federal or State forms or logs will be maintained at the office of Contract Dewatering.

8.4 Decontamination Plan

Consistent with the levels of protection required, step-by-step procedures for personnel decontamination for each Level of Protection are given below.

LEVEL D / MODIFIED LEVEL D / LEVEL C - DECONTAMINATION PLAN

Segregated equipment drop	Drop equipment in a designated area for decontamination or proper disposal
Tape removal - outer glove and boot	If necessary
Boot cover removal	If necessary, place in trash bag or disposal container
Outer glove removal	If necessary, place in trash bag or disposal container
Suit removal	If necessary, place in trash bag or disposal container
Inner glove removal	If necessary, place in trash bag or disposal container
Respirator Cartridges	If necessary, place in trash bag or disposal container

CRC / SAFE ZONE BOUNDARY

Field Wash	Wash hands and face with soap and water as soon as possible and before eating or drinking or other hand to mouth activity.
Disposal Plan, End of Day	At end of the day the trash bag with the PPE will be closed up and staged in a secure area.
Disposal Plan, End of week	Material will be stored in a secure area.
Disposal Plan, End of project	Material will be disposed of in an appropriately permitted landfill

8.4.1 Levels of Protection Required for Decontamination Personnel

The level of protection required for personnel assisting with decontamination will be **Level D** unless **Level C** has been initiated, then **Level C** is required.

8.4.2 Disposition of Decontamination Waste

All decontaminated wastes generated by Contract Dewatering personnel will be staged with the contractor decontamination waste and will be disposed of in an appropriately permitted landfill. Subcontractor will be responsible for disposal of investigative derived wastes.

8.4.3 *Equipment Decontamination*

The stepwise procedure for decontamination of any Contract Dewatering sampling equipment is available in the Contract Dewatering operations manual and includes thoroughly washing the equipment with algonox and triple rinsing with clean water. Disposable bailers will be used for monitor well sampling and disposable latex gloves will be worn for all sampling activities, A procedure for decontamination steps required for non-sampling is as follows:

If Contract Dewatering equipment (phone, PID, etc.) requires decontamination, they will be wiped down with a paper towel soaked in an alconox water wash and rinsed with a clean water rinse.

Any subcontractor and their subcontractors will be responsible for the decontamination procedures of their equipment and their procedures will be identified in their respective HASP documents.

9.0 SITE PERSONNEL CERTIFICATION / RESPONSIBILITIES

The Site Health and Safety Manager is responsible for verifying all certifications and fit tests.

	Richard Neumann	*Barry Mefford*		
Title	**Project Manager**	**Site Safety Manager**		
Tasks	**All**	**All**		
Relevant Cert. Completed	**All**	**All**		
Medical Current *	**Yes**	**Yes**		
Training Current **	**Yes**	**Yes**		

*** Medical Current - Medical Monitoring Requirements: All personnel including visitors, entering the exclusion or contamination reduction zones must be certified as medically fit to work, and to wear a respirator, if appropriate, in accordance with 29 CFR 1910, 29 CFR 1926/ 1910 or 29 CFR 1910.120.**

**** Training Current - Training: All personnel, including visitors, entering the exclusion or containment reduction zones must have certifications of completion of training in accordance with OSHA 29 CFR 1910, 29 CFR 1926 or 29CFR 1910.120.**

9.1 RESPONSIBILITIES OF FOREMAN / QUALIFIED EMPLOYEE

1. Assure that the safety program is implemented.

2. Inspect the job site to assure that no unsafe conditions exist.

3. Make sure that necessary protective equipment is on hand and used when required.

4. Instruct all employees in safe procedures and job safety requirements. Follow up and insist on compliance.

5. Discuss safety with employees on every operation. Have periodic safety meetings.

6. See that all injuries are cared for properly and reported promptly.

7. Investigate all accidents. File a complete accident report with the Safety Officer and correct the causes immediately. USE OSHA FORM 200.

8. Be familiar with the rules pertaining to safety.

9. Report any hazardous conditions to the Safety Officer even if the condition has been corrected.

10. Recommend reprimands for employees found in non-compliance of safety program and related materials.

9.2 DISCIPLINE POLICY

It is the policy of **Contract Dewatering** to supply its employees with a workplace which is free from recognized hazards. **Contract Dewatering** will provide to each employee the proper tools, equipment, **Contract Dewatering** is concerned with your safety and requires you to take advantage of these measures for your protection.

In order to ensure your compliance with this policy, the following schedule of disciplinary action shall apply to any employee found to be in violation of the required procedures:

First Offense -	Written warning filed in employees permanent file (effective for one year from date of issue).
Second Offense -	Written warning filed in employees permanent file (effective for one year from date of issue).
Third Offense -	Subject to suspension without pay for a length of time to be determined at time of offense.
Subsequent Offenses-	Subject to dismissal or suspension without pay for a length of time to be determined at time of offense.

Safety is everyones' responsibility. The safety rules of **Contract Dewatering** in place to protect you and your fellow employees and these rules will be enforced.

Employee Signature: _____

Date: _____

10.0 TRAINING AND BRIEFING TOPICS

The following items will be covered at the site-specific training meeting, daily or periodically:

- Site characterization and analysis, Sec. 3.0, 29 CFR 1910.120I
- Physical Hazards, Section 3.2.
- Chemical Hazards, Section 3.4.
- Animal bites, stings and poisonous plants
- Site Control
- Engineering Controls and Work Practices
- Heavy machinery - Drill Rig
- Backhoe
- Equipment
- Tools
- Overhead and Underground Utilities
- Personnel Protective Equipment, Section 5.4; 25 CFR 1910.120a
- Level D
- Monitoring, Section 6.0; 29 CFR 1910 120h
- Decontamination, Section 7.4; 29CFR 1910, 120k
- Procedures for handling site emergency incidents
- Shipping and transport. 49CFR 172.101
- Illumination. 29 CFR 1910.120m

11.0 SUBCONTRACTOR'S HEALTH AND SAFETY PROGRAM EVALUATION

Subcontractors are responsible for their own HASP, which will be reviewed by Otwell Mawby. The activities to be conducted by an on-site subcontractor include tank excavation and removal.

Appendix A

Job Hazard Analysis

1. MOBILIZATION AND DEMOBILIZATION

Hazard: Equipment Accidents

Controls:

a. Assure that all equipment (including trucks) are equipped with ROPS, seat belts, back-up alarms, and fire extinguishers.
b. Use signaler while loading and unloading. Act only on signaler's signal. Signaler shall wear a reflective orange vest.
c. Assure that all equipment is in safe operating condition.
d. Limit loading and off-loading during wet or freezing conditions.
e. Require use of seat belts.
f. Use only trained and authorized equipment operators.
g. Equipment inspections at the start of each shift. All equipment removed and subsequently returned to the site shall be reinspected.

Hazard: Material Handling Accidents

Controls:

a. Furnish personal protective equipment such as hard hats, gloves, protective shoes, eye protection, etc.
b. Instruct employees in proper lifting techniques to prevent back injury. Reinforce proper lifting technique when lifting observed.
c. Use equipment whenever possible for lifting (with proper lifting apparatus.)
d. Disallow employee's exposure to suspended loads
e. Use only qualified "riggers" for hooking, lifting and landing materials.

2. FUEL STORAGE AND EQUIPMENT REFUELING

Hazard: Fire

Controls:

a. Furnish and mount fire extinguishers.
b. Place "No Smoking" and "No Open Flame" signs on storage tanks.
c. Place dikes around storage tanks.
d. Prohibit smoking or open flames with 50 feet of where equipment is being refueled.
e. Dispensing systems shall be electrically bonded and grounded.
f. Portable fuel containers shall be approved safety cans.
g. Storage tanks shall be equipped with relief valves.

3. USE OF CRANE OR BOOM TRUCK

Hazard: Equipment Accidents

Controls:

a. Operator will have chard posted so as to know maximum loads at different boom angles.
b. Safety belts shall be worn at all times.
c. Boom will be kept at a safe distance from power lines. It will never be closer than 10 feet.
d. Operator shall not leave crane unattended when holding a load.

Hazard: Falling

Controls:

a. Anyone lifted shall be secured with a safety belt.
b. Operator shall be positioned so as to see man in the basket at all times.
c. Persons shall be lifted only with cranes that have power up and power down modes.

4. EXCAVATION AND EMBANKMENT/ PLACING AGGREGATE AND STONE

Hazard: Equipment Accidents

Controls:

a. Assure that all equipment (including trucks) are equipped with ROPS, seat belts, back-up alarms and fire extinguishers.
b. Rigid schedule and equipment safety component and preventative maintenance.
c. Orient equipment operators in safety methods.
d. Inspect all equipment at beginning of workshift to determine safe operating conditions.
e. Require use of seat belts.

f. Use signalman. Signalmen shall wear orange reflective vests.

5. CONCRETE
Hazard: Concrete Burns
Controls:
a. Assure employees wear proper clothing and safety equipment (i.e. long sleeves, boots, safety goggles, gloves, etc.)
b. Use trained and experienced personnel only.
c. Assure personnel using curing compound to wear safety glasses.

6. FORMWORK
Hazard: Personal Injury
Controls:
a. Forms will be stacked out of the way of equipment
b. Nails will be removed, as forms are unassembled.
c. Those using release agents will wear eye protection.
d. Heavy large forms will be handled with several men or equipment.

7. CLEARING
Hazard: Chain Saws
Controls:
a. Inspect chain saws at the beginning of work shift to determine safe operating conditions.
b. Furnish personal protective equipment such as eye, ear, hand foot (safety shoes) protection, etc.
c. Assure that operators are aware of proper operating procedures such as sure footing, holding the saw with both hands, etc.
d. Educate employees to the dangers of falling trees, kick-back, etc.
e. Assure that operators are aware of any obstacles lying in the path of falling trees.

8. HOUSEKEEPING
Hazard: Personal Injury
Controls:
a. Tools, materials, extension cords, hoses or debris shall not cause tripping or other hazards.
b. Empty bags containing lime, cement or other dust-producing material shall be removed periodically.
c. Protruding nails in scrap boards, planks and timber shall be removed, hammered in or bent over flush.

d. Walkways, runways and sidewalks shall be kept clear of all obstructions. Adequate accessways shall be provided and protected.
e. Keep gas and other flammable materials away from heaters and in a secure area.
f. Wet or oily spills shall be cleaned up immediately.
g. Be sure heaters have proper ventilation and clearance from walls.
h. Gas cans must have fire arresters and screens.

9. USE OF ELECTRICAL TOOLS
Hazard: Fires – Electrical Shock
Controls:
a. Have approved fire extinguishers on site.
b. Patched, oil soaked, worn or frayed electrical cords or cables shall not be used.
c. GFI shall be required for use with any electrical tool.
d. Maintain electrical power equipment daily and check for cracked, split or frayed cords and repair same.
e. Wet hands or standing water is prohibited when using and electrical tool.
f. Make absolutely sure that the electrical power tool being used has a true ground or is double insulated.
g. Do not abuse or misuse power tools or handle them by their electrical cords.

10. POWER TOOLS
Hazard: Personal Injury
Controls:
a. Power tools shall not be left running and unattended. Only experienced operators will be allowed to use power tools.
b. Eye protection, face shields, and hearing protection shall be worn.
c. Proper personnel safety equipment shall be used.
d. Use the right tool for the right job.
e. Tools shall be kept in proper working order and checked daily, including protective guards.
f. Electrical cords shall be in good condition and properly grounded.
g. Avoid using aluminum or other metal ladders on electrical jobs or near electrical lines.

11. DRILLING EQUIPMENT
Hazard: Personal Injury
Controls:

a. Equipment operators shall be properly trained in the operation of their specific type of drilling rig.
b. Make sure drilling rig has gone through a visual inspection to identify any present safety hazards.
c. Be sure that all guards are in place and all pinch points are identified.
d. Proper eye and ear protection must be worn at all times.
e. Drill rig shall be equipped with a fire extinguisher, OSHA approved first aid kit, and OSHA approved safety belts and lanyards for climbing on rig or derrick.
f. Helpers and support personnel shall be briefed on all related health and safety hazards prior to beginning each phase of the work.
g. Any open hole shall not be left unprotected; it shall be covered and identified with a caution tape barrier.
h. All lifting apparatuses, cable and rigging hardware shall be visually inspected daily and any deficient equipment or material shall be replaced before any work may continue.
i. Weather conditions shall be monitored and at the first sight of lightning, the drilling crew will shut down until the threat of lightning is out of the area.
j. Should any drilling fluids be used, MSDS sheets will be available for review by any workers on site.
k. When any drilling is performed on sheeting cells or near sheeted excavations where a falling hazard would occur, hand rails must be in place before CDS employees can begin any of their work.
l. On any drilling location, if open water hazards are present, PFD's will be worn by the workers that are in the hazard areas.

Appendix B

CONTRACT DEWATERING SERVICES INC.
EMPLOYEE SIGN-OFF SHEET

_____, an employee of **CONTRACT DEWATERING SERVICES, INC.** have read and understand this health and safety policy. I also understand that if I have any questions concerning the safety policy or safety in general I may contact the company safety officer for clarification. Further, I understand that safety is everyone's responsibility, including my own.

Signed: _____

Date: _____

APPENDIX H

Specifications for Soil – Bentonite Separation Barrier Wall

Part 1 – General

1.1 Scope

A. The scope of this specification included all the materials, equipment and personnel required to construct a vertical separation wall along the alignment shown on the Drawing C-2, prepared by Montgomery Watson and dated September 2000. The purpose of this work is to construct a soil-bentonite cutoff wall extending from the ground surface to a point 2 feet below the surface of a silty clay deposit which underlies the site below approximately elevation 618.5. The separation barrier wall is to be constructed using a one pass trencher capable of thoroughly blending a soil – water – bentonite into a uniform mixture. The final soil-bentonite mix is to contain 4 pounds of bentonite by dry weight per cubic foot of trench.

Part 2 – Materials

2.1 Bentonite

A. Bentonite material shall consist of Hydrogel 90 as manufactured by Wyo-Ben, Inc

2.2 Water

A. Water shall be potable.

2.3 Soil

A. Soil shall be existing, in place materials free of refuse and debris.

Part 3 – Equipment

3.1 Equipment

A. Trencher – The trencher equipment used to construct the Separation Barrier wall shall be a one pass chain trencher with a minimum excavation width of 24 inches. The trencher shall be self-propelled and capable of continually rotating the trencher chain so that full and continuous mixing of the soil-water-bentonite mix may occur over the full depth of the excavation.

B. Slurry mixing and distribution system – The slurry mixing and distribution system shall be capable of uniformly mixing and maintaining in a mixed state the water-bentonite slurry.

C. Slurry metering system – The slurry metering system shall contain a flowmeter capable of continuously monitoring the rate of flow of water-bentonite slurry passing into the trencher.

D. During freezing weather, provide tank heaters or continuous circulations systems to keep the water-bentonite slurry from freezing.

Part 4 – Execution

4.1 Execution

A. Layout Separation Wall alignment and excavate a shallow pre-trench along the alignment.

B. Place required measured weight of dry bentonite into pre-trench.

C. Insert Trencher and mix soil-water-bentonite until uniform mix is formed.

D. Begin travel with trencher, control rate to achieve continuous, uniform soil-bentonite mixture with a slump in the range of 4 to 8 inches.

4.2 Terminations

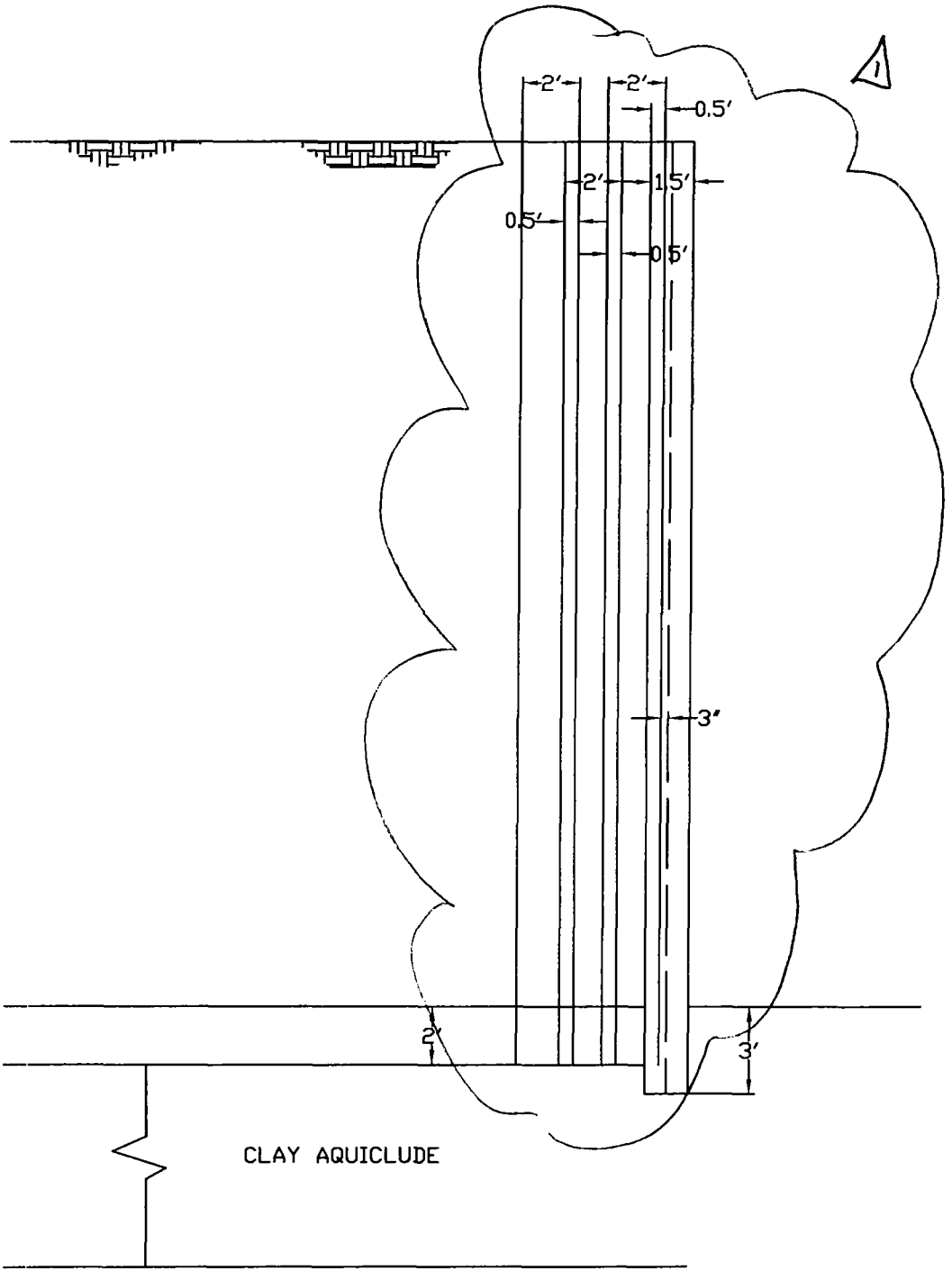
A. At ends of Separation wall trench backward to existing perimeter barrier wall. Stop approximately 3 feet short of perimeter wall and make connection as shown on detail.

Part 5 – Quality Control

5.1 Quality Control

A Perform quality control in accordance with the contractors approved quality control program.

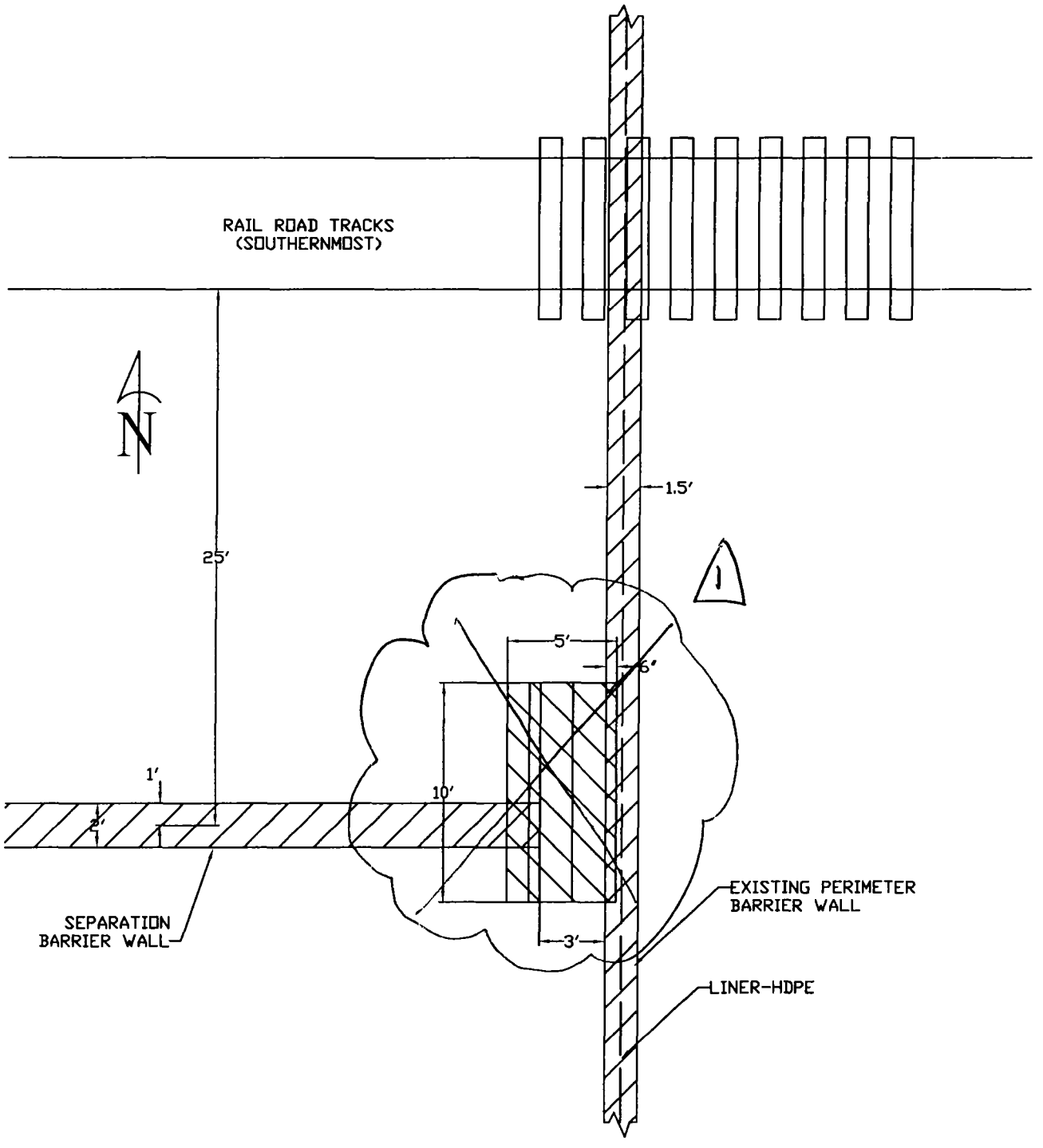
APPENDIX I



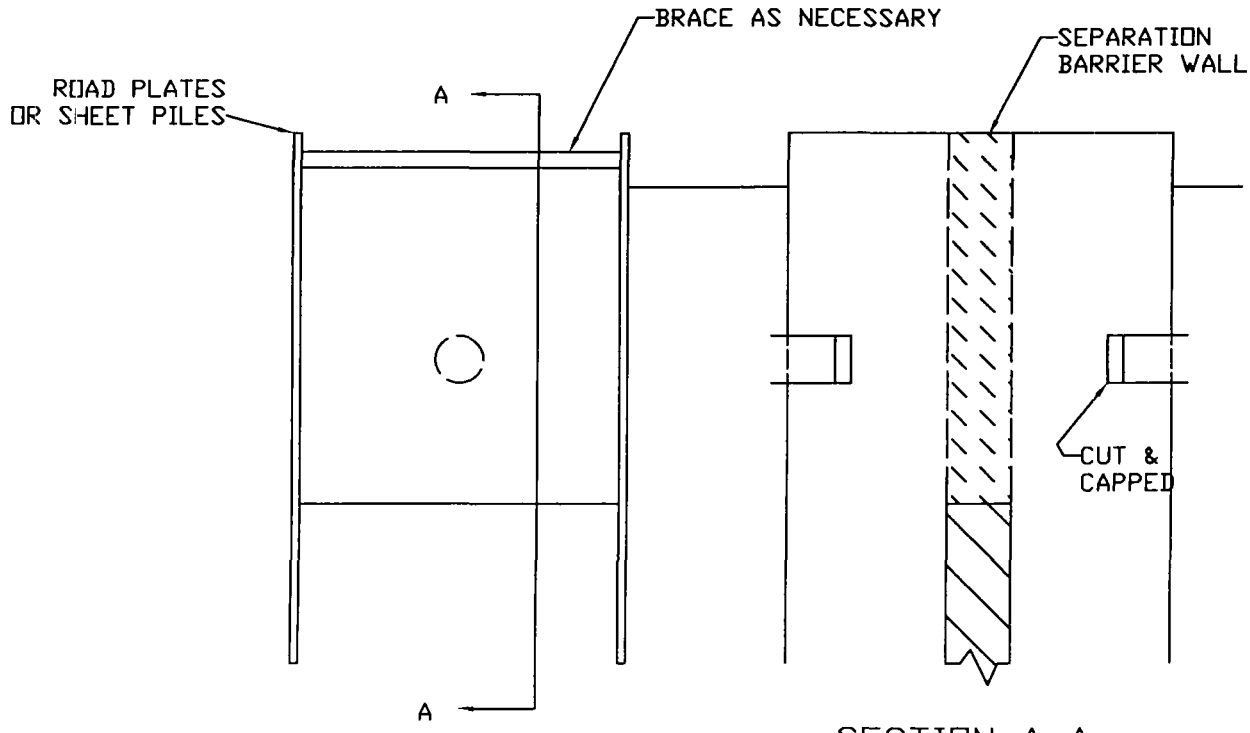
1 DELETE ENCLOSED AREA

TERMINATION DETAIL
SECTION VIEW
SCALE: NONE

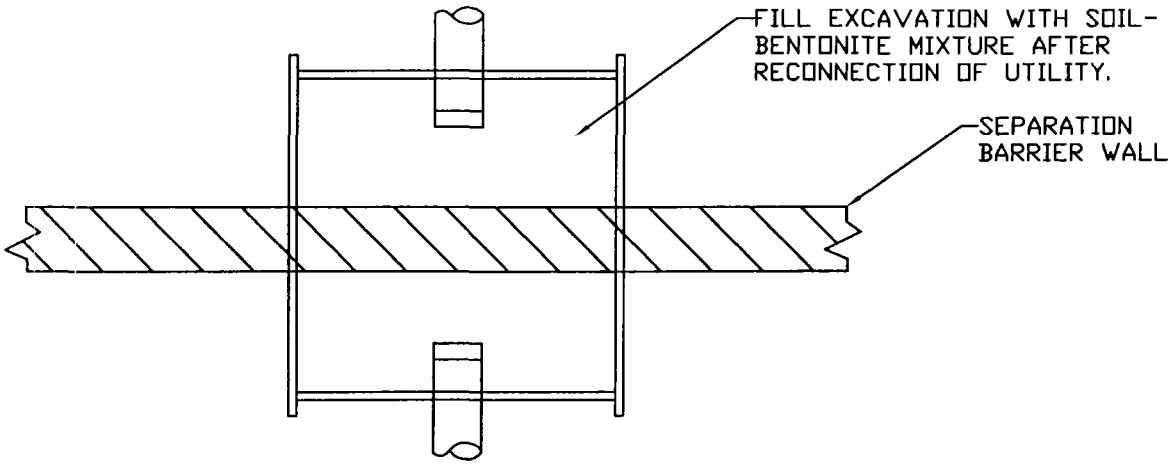
NOTE: THIS DRAWING SHOULD BE DISREGARDED



TERMINATION DETAIL
PLAN VIEW
SCALE: NONE



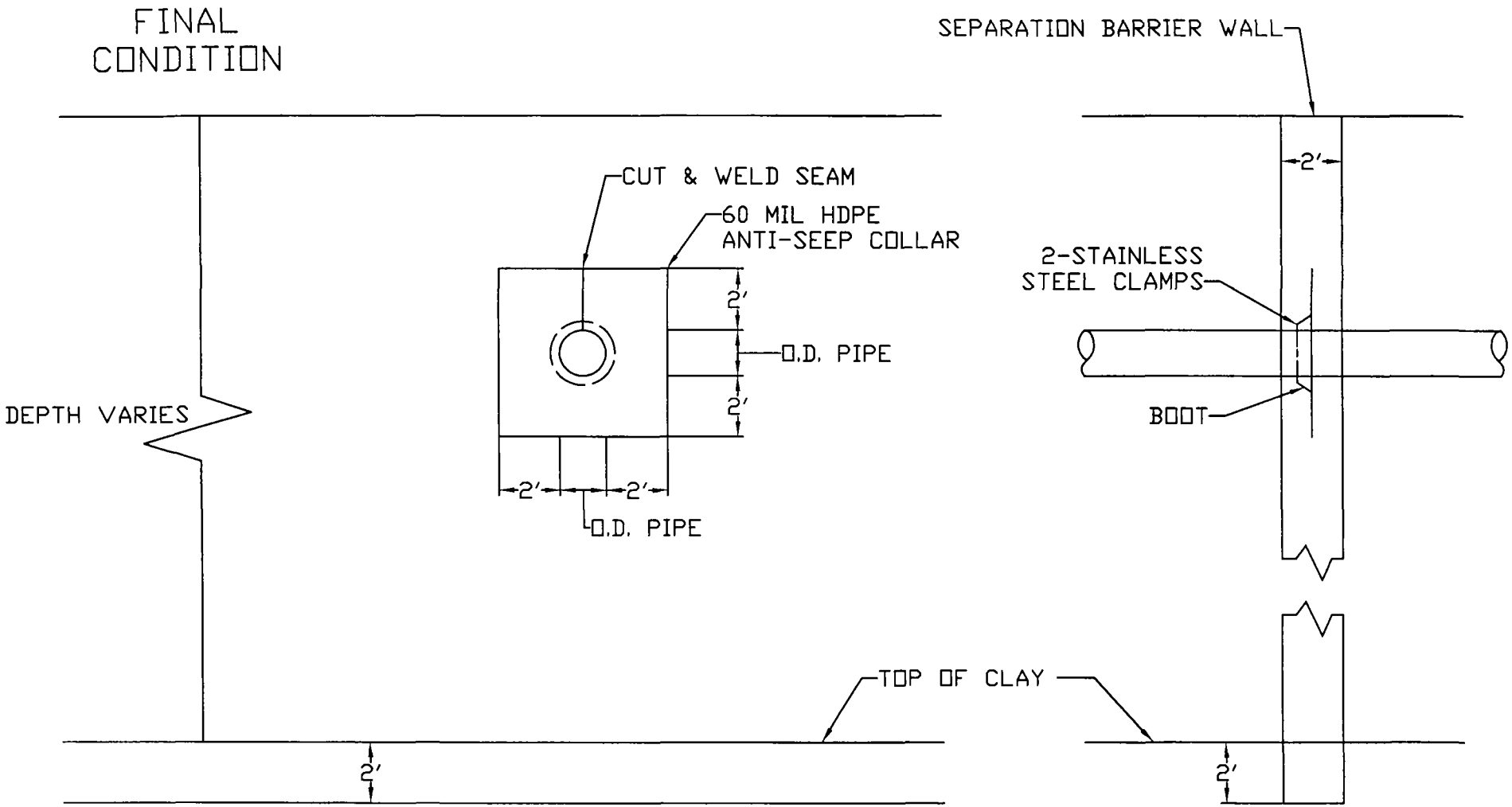
SECTION A-A



PLAN VIEW

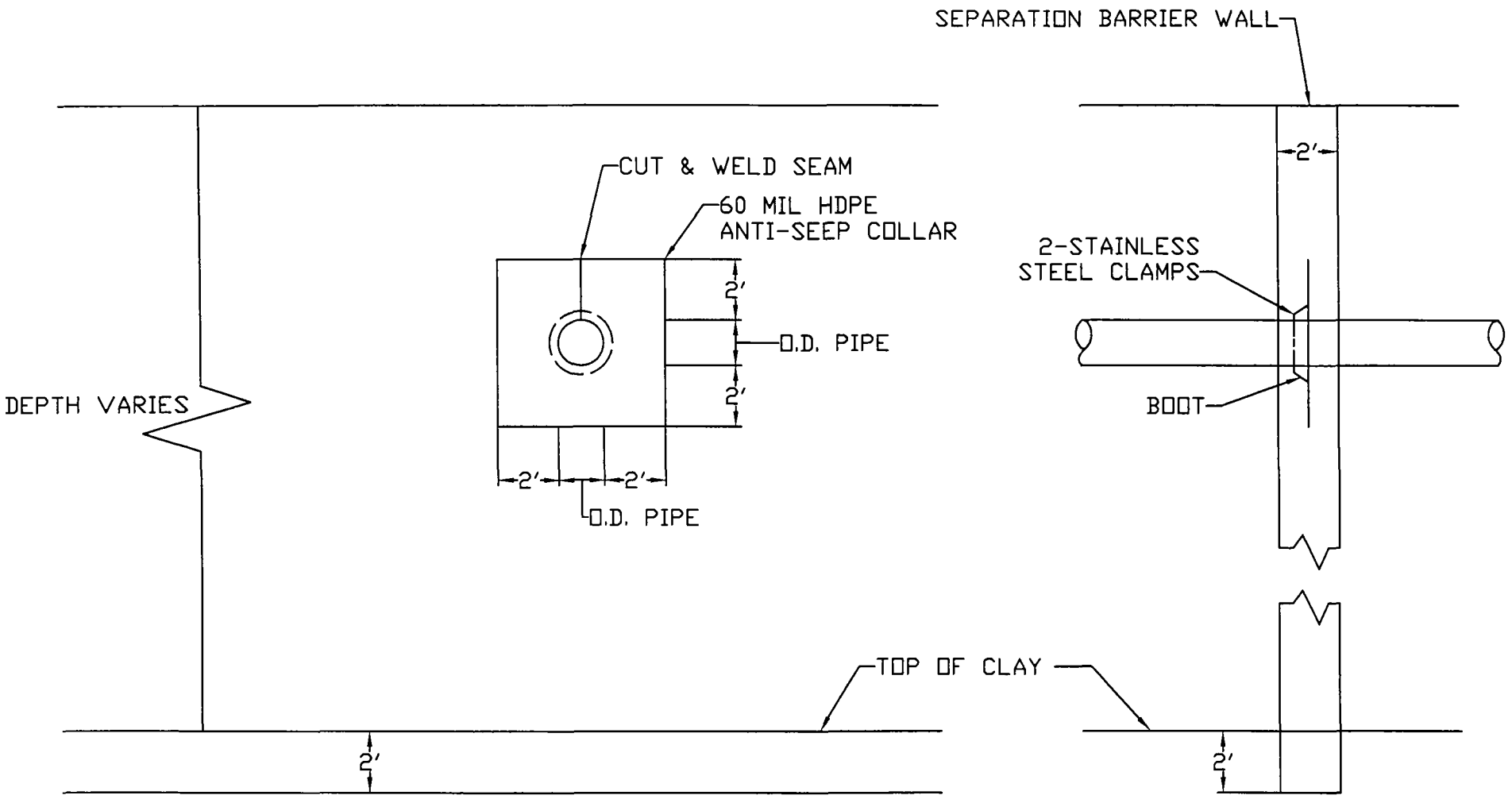
UTILITY CROSSING DETAIL

SCALE: NONE



UTILITY CROSSING DETAIL
SCALE: NONE

FINAL
CONDITION



UTILITY CROSSING DETAIL
SCALE: NONE